report

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NATO Standardization and Licensing Policy — Exploratory Phase

VOLUME II: MAIN REPORT

by

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Prepared for:

European/NATO Directorate
Office of the Assistant Secretary of Defense
for International Security Affairs

November 1976

Contract No. MDA 903-76-C-0284
Contract Expiration: 31 December 1976
Short Title: NATO Standardization

Contractor: General Research Corporation
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GENERAL RESEARCH CORPORATION
WESTGATE RESEARCH PARK, McLEAN, VIRGINIA 22101

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This study describes the US and European political, economic and technological context for licensed production as a tool for standardization or interoperability, identifies particular problem areas, discusses potential candidate systems, and recommends policy approaches to further the goals of NATO standardization and interoperability. Particular attention is focused on (1) US political and economic framework for licensed production, (2) European political, industrial

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and technological factors.

Volume I is the executive summary; Volume II contains the main report and appendices; Volume III supplements the main report by GRC with an extensive survey of European industrial capacities and perspectives on standardization conducted by Hoagland, MacLachlan & Co., Inc., subcontractor to GRC.

PREFACE

Weapons standardization has been an elusive goal of NATO since its founding in 1949. It is widely recognized that NATO suffers diminished combat capability as a result of lack of standardization. Standardization and interoperability have recently been given new urgency in the light of Soviet and Warsaw Pact conventional force modernization programs. Also, the cost-budget squeeze in NATO countries, caused by competing domestic priorities and increasing R&D, procurement, and manpower costs, has added economic incentives to the military incentives to achieve greater collective military effectiveness and more efficient use of collective resources through weapons standardization and improved interoperability. New initiatives have been taken on both sides of the Atlantic to develop better NATO policies, institutions, and procedures to address the long-standing problems of standardization and interoperability.

Both the US Congress and the Executive Branch have committed the United States to greater cooperation with European allies in achieving the goals of NATO standardization and interoperability on the basis of a "two-way street" across the Atlantic in weapons selection and acquisition. Both have also singled out licensed production or co-production of weapons developed by another country as a promising device to this end. Because of this emphasis on licensing, the Office of the Assistant Secretary of Defense for International Security Affairs (ISA) contracted with the General Research Corporation (GRC) in June 1976 for a two-months exploratory phase of assistance in evaluating weapons licensing policy within NATO. To perform the study, GRC augmented the capabilities of its own staff with the assistance of a subcontractor and consultants

who have extensive experience in NATO political, military, and industrial matters. Full documentation of the literature examined and of the officials in the US Executive Branch, the Congress, European Embassies, and industry who were interviewed is provided in Volume II, which contains the main report and its appendices. The subcontractor, in Volume III, has provided a survey of the European defense industrial environment within which new US initiatives regarding standardization and interoperability will have to function.

The authors of this report express their deep appreciation to the numerous officials who gave generously of their time to the interviews conducted in this study; to Major General Richard C. Bowman, Director, European and NATO Affairs, ISA, who provided study guidance and encouragement; to Mr. Jerrold K. Milsted, Special Assistant to the Principal Deputy Assistant Secretary of Defense, ISA, who served ably and efficiently as the Contracting Officer's Technical Representative; and to COL Larry J. Larsen, Chief, and COL Harold W. Holtzclaw, Project Officer, in the NATO Standardization Division, ISA, for their many suggestions, documentary search assistance, and support in obtaining interviews with busy officials.

The views and judgments expressed in this report are those of the authors and do not necessarily reflect the views of ISA or any official interviewed in the performance of the study.

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Separately bound

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Chapter 1
INTRODUCTION

BACKGROUND

In the past two years, the US President, DoD and State Department officials, and Congressional leaders have asserted a renewed US interest in standardization and interoperability within NATO. A central aspect in these statements has been the desirability of increased licensed production and co-production of weapons systems by more than one Ally. As the DoD action office on standardization, ISA is concerned with the prospects for, and difficulties of, licensed production. ISA therefore requested the assistance of the General Research Corporation in studying these issues and evaluating weapons licensing policy within NATO.

OBJECTIVE

The stated objective of the study is to "examine, evaluate and document aspects of weapons licensing policy within NATO" and to "recommend to the Office of the Secretary of Defense selected policy approaches that might further the goals of NATO standardization and interoperability." The study is exploratory rather than definitive and seeks to aid ISA in developing policy recommendations across the entire spectrum of NATO procurement requirements.

SCOPE AND APPROACH

The study was conducted along five parallel paths covering the following subject areas:

1. The US political and industrial framework.

The staff analyzed Executive Branch initiatives and Congressional interest as expressed in legislation and committee statements. Note was

also taken of potential Congressional opposition to standardization and of the continuing importance of "Buy American" pressures. A range of industry views was solicited. Chapter 2 discusses Executive Branch, Congressional, and industry positions and documents and assesses their impact on licensing and co-production in NATO. Research consisted of analysis of DoD, State Department, Congressional, industrial, and NATO documents and, second, of interviews with knowledgeable policy-makers and staff specialists in the Executive Branch, Congress, industry, and European embassies. Appendix C lists the personnel consulted. Appendix D and the references at the ends of the chapters and of Appendixes A and B list the documents examined.

2. Lessons from licensing experience.

Chapter 3 describes four general patterns of licensed production and co-production that have developed in NATO within the past quarter century. Chapter 3 also discusses related issues and inferences from this experience for future US policy. Appendix A presents the significant features of a representative sample of international licensing arrangements for production and co-production. Appendix B provides backup material by summarizing and commenting on key NATO and US documents concerning licensing and co-production. Appendix B includes the key terms and typical content of a license, a discussion of the current US directives and guidelines for licensing, and examples of intergovernmental Memoranda of Understanding.

3. European institutional and political framework.

Analyses of standardization often speak of "rationalization" of NATO efforts solely in terms of long-range US goals. In contrast, Chapters 4 and 5 of the present study examine specifically European concerns. These chapters assess the impact on standardization of the European desire to compete with the US in "high technology" R&D and in sales to other countries.

Chapter 4 analyzes recent European institutional and policy developments that affect licensing as a tool of standardization. Chapter

4 includes an overview of the European standardization forums, analyses the policy stances of the principal European states, discusses the "two-way street" concept and the concept of "rationalization" of military development and production, and assesses three possible US policy responses in the areas of licensing, sales, co-development, and co-production.

4. European industrial and technological factors.

Chapter 5 provides a survey, presented in complete form in Volume III, of the European industrial environment within which US initiatives regarding standardization and interoperability will have to function. Chapter 5 surveys the principal European defense industrial sectors - aircraft, missiles, shipbuilding, and tanks and guns. Country and corporate profiles are produced for each industrial sector, and inferences are drawn regarding probable European industrial response to different types of US licensing initiatives. Major differences from US priorities are discussed in such areas as size of industry, importance of production, continuity and stability of employment, and relations of government to industry.

5. Specific areas and candidate systems for licensed production.

Chapter 6 discusses each of the major areas of tactical warfare. It identifies those areas where level of technology and coincidence of national development cycles and tactical needs make licensed production most likely. The chapter also notes the inevitable difficulties in agreeing on standardization of specific systems and recommends that efforts be concentrated on those systems that promise the highest military and political/economic payoff.

INTEGRATION AND SYNTHESIS

Chapter 7 provides an integration of the findings and assesses licensed production and co-production in the light of the military, political, and industrial factors and constraints described in earlier chapters. Advantages and disadvantages of licensing and its key problem areas are discussed. Conclusions and recommendations are presented concerning the role that licensed production may be expected to play in achieving

greater standardization or interoperability of weapons within NATO and concerning some of the most promising policies and immediate steps that should be pursued to facilitate that role.

Chapter 2

US TRENDS AFFECTING LICENSING AND CO-PRODUCTION IN NATO

GENERAL

Background

This chapter reviews and evaluates current policy positions of the United States Government, and current trends in US industry's thinking, with respect to licensing arrangements for the production of weapon systems and other defense equipment for NATO use. The review and evaluation of licensing arrangements are set in the broader context of US international and domestic interest in promoting rationalization, standardization and interoperability in NATO.

In recent years, there have been far-reaching changes in that context. The United States' early, dominant position as the principal supplier of NATO's defense equipment has undergone increasing erosion. Straight sales of US weapons sytems to European NATO nations are now difficult or impossible to achieve, and growing numbers of European designed and European produced systems compete in the NATO market place. There is widespread discussion of the "two-way street" in arms transactions within NATO, as the European allies demand what they regard as a fairer share of Alliance arms sales.

Both the United States and its NATO partners subscribe publicly to the goal of standardization, and both recognize that past efforts to achieve that goal have been singularly unsuccessful. New approaches, such as a NATO "common defense market" (Ref. 1) are being considered. But however desirable such sweeping approaches may be in principle, they may not be within the art of the politically possible, at least in the near future.

Recent attention has also focused on less ambitious approaches or devices—measures that can contribute to standardization and consequently to improved military effectiveness but that, at the same time, are likely to be economically viable and politically palatable in the short run. The current emphasis within NATO Europe on the goal of interoperability (discussed below) is compatible with such a pragmatic, limited-objective approach. Similarly, present interest in licensed production and co-production in the US Government (and to some extent US industry) focuses on a specific vehicle for moving toward military standardization that might be said to represent a compromise between the extremes of US protectionism (and "Buy American") and some form of supranational NATO defense procurement mechanism or an Atlantic common defense market.

The Nature of Licensed Production

The terms "licensed production" and "co-production" are used somewhat loosely and largely interchangeably in many discussions and documents on standardization in NATO. However, there is a distinction between them. Licensed production is production made possible by agreements under which developers of military hardware provide data, patent rights, technical assistance and whatever else is necessary to enable production of the desired hardware by a source in another country. The developer is usually compensated by licensing fees and/or royalties on sales and by various other means (Ref. 2, p 28).

Co-production is any arrangement, either through government-to-government agreement, or through specific licensing procedures by designated commercial firms, to permit production of specific equipment or components thereof in several countries. Co-production could result from direct government-to-government agreements without the direct involvement of commercial firms in negotiating licensing agreements (Ref. 3, p 2). Co-production generally involves licensed production of components and thus presents many of the same advantages and disadvantages of licensed production.

The next three sections summarize US Government policy developments and US industrial views relevant to licensed production, with particular attention to trends that tend to facilitate the use of this mechanism for promoting standardization and interoperability in NATO.

CONGRESSIONAL INVOLVEMENT

The Congress of the United States has long been favorably inclined toward the principle of standardization as a means of strengthening the defense of Western Europe. As early as 1948, Senator Vandenberg and others stressed the importance of standardization of military equipment. The following year, in approving unanimously the North Atlantic Treaty, the Senate Foreign Relations Committee recorded the view that the Treaty would "greatly stimulate the efforts of the North Atlantic states to help themselves and help each other and, through proper coordination of these efforts, to achieve maximum benefits with minimum costs..." (Ref. 4, pp 13,14).

During recent years, there has been an upsurge of activity in the Congress (mainly in the Senate), designed to improve the climate for standardization in NATO, and to lend support to and provide underpinning for Administration efforts to promote standardization.

Standardization Amendments

The Nunn Amendment (Section 302 of Public Law 93-365, August 5, 1974) directed the Secretary of Defense to:

- Assess the costs and loss of nonnuclear combat effectiveness that results directly from the failure of NATO nations, including the United States, to standardize.
- Develop a list of recommended standardization actions and evaluate the priority and effect of each such action.
- Submit results to the Congress and subsequently to NATO for inclusion in the overall review of foreign goals and development of force plans.
- Report semi-annually to the Congress on progress achieved in these areas. (The Congress later revised this to a requirement for an annual report.)

The first report in response to this requirement was submitted on April 28, 1975. It provided an overview of standardization and its importance to Alliance military capability, resource utilization and foreign policy; a discussion of the causes of destandardization; and a description of Department of Defense strategy toward achieving standardization objectives (Ref. 5).

The Culver-Nunn Amendment (Section 814) of Public Law 94-106, October 7, 1975), was a product of lengthy Conference discussions. As originally proposed and passed by the Senate, the Amendment expressly authorized the Secretary of Defense to waive the provisions of the "Buy American Act"* in order to facilitate the procurement of standard NATO equipment for US forces stationed in Europe. While the House conferees favored the goals of standardization, they expressed concern that the proposed language could be misconstrued and possibly used to "our disadvantage." Reference to the "Buy American Act" was therefore deleted.

The Culver-Nunn Amendment of 1975 contains in substance the following relevant provisions:

- It is the sense of the Congress that equipment for US Forces in NATO should be standardized or made interoperable with that of other members of NATO to the maximum extent possible.
- The Secretary of Defense shall carry out procurement procedures that provide for the acquisition of standardized or interoperable equipment whenever such equipment is designed primarily to be used by US military personnel stationed in NATO Europe.

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* The "Buy American Act" requires that only domestic products be procured for public use, but it provides four statutory exceptions to that general mandate: (1) when the head of the department . . . concerned determined that it would be "inconsistent with the public interest"; (2) when procuring domestic supplies would entail unreasonable costs; (3) when the supplies are to be used outside the United States; and (4) where supplies are of the class or kind not manufactured in the United States "in sufficient and reasonably available commercial quantities and of a satisfactory quality." (41 USC 10, a-d.)

- The Secretary of Defense shall report to the Congress on the initiation of procurement action on any new major system not in compliance with the policy set forth above.

Thus, the Culver-Nunn Amendment of 1975 provided some new encouragement for standardization and interoperability in NATO; but it did not provide a specific "assist" to the Secretary of Defense in waiving the "Buy American Act" provisions.

In January 1976, the Secretary of Defense submitted the second annual report to the Congress, this one entitled Rationalization/ Standardization Within NATO (Ref. 6). This report responded to requirements set forth in both PL 93-365 and PL 94-106, described above. In addition to covering weapon system standardization matters, this report was broadened to cover, under the heading of rationalization, such areas as military doctrine and force structure, training, communications and logistics. It also stressed the need for Allied cooperation across the board.

The DOD Appropriation Authorization Act, 1977 (PL 94-361, approved July 14, 1976, Sec. 802 and 803), embodies in legislation some highly important provisions affecting NATO standardization in general, and licensed production within NATO in particular. The following are, in substance, the principal relevant provisions:

- It is the policy of the United States that equipment for US forces stationed in NATO Europe should be standardized or at least interoperable with equipment of other members of NATO.
- In carrying out such policy, the Secretary of Defense shall, to the maximum extent feasible, procure equipment that is standardized or interoperable whenever such equipment is to be used by US forces stationed in NATO Europe.
- Procurement procedures employed by the Secretary of Defense shall take into consideration the cost, functions, quality and availability of the equipment to be procured.*

* This provision was presumably included because of House concerns over the effect on the domestic economy of the pro-standardization language elsewhere in the law.

- The Secretary of Defense shall report to the Congress on all agreements entered into with other NATO members for acquisition of equipment manufactured outside the US pursuant to agreements by other NATO members to acquire equipment manufactured in the US.
- The Secretary of Defense is explicitly authorized to waive the provisions of the "Buy American Act" when procuring equipment outside the United States in conformity with Congressional enactments in support of NATO standardization.*
- The Secretary of Defense shall report to the Congress on the initiation of procurement action on new major weapons systems that are not standard or interoperable with equipment of other NATO members.
- It is the sense of the Congress that weapon systems developed for use in the NATO theater shall conform to a common NATO requirement in order to proceed toward joint doctrine and planning and to facilitate maximum feasible standardization and interoperability of equipment. A common NATO requirement shall be understood to include a common definition of the military threat to NATO countries. The Secretary of Defense shall identify R&D programs for US forces in Europe and the common NATO requirements such programs support. The Secretary shall report on actions taken within NATO in pursuit of common requirements, and on efforts to establish regular procedures within NATO for determining common military requirements.
- It is the sense of the Congress that progress toward the realization of the objectives of standardization and interoperability would be enhanced by expanded inter-Allied procurement of arms and equipment within NATO. It is further the sense of the Congress that expanded inter-Allied procurement would be facilitated by greater reliance on licensing and coproduction agreements among the signatories of the North Atlantic Treaty [underlining added]. It is the Congress' considered judgment that such agreements, if properly constructed so as to preserve the efficiencies of scale, could not only minimize potential economic hardship to participants, but also increase the survivability of the Alliance production base.

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* Senator Nunn described this provision as "a signal to our NATO allies of our serious intent towards standardization" (Ref. 7, p. S11321).

- Accordingly, the Secretary of Defense shall attempt to the maximum extent feasible (1) to identify areas for such cooperative arrangements, and (2) to negotiate such agreements, pursuant to the ends of standardization and interoperability. The Secretary of Defense shall report to the Congress on specific assessments made under the above provisions and on the results achieved with NATO allies.
- It is the sense of the Congress that standardization of weapons and equipment within NATO on the basis of a "two-way street" concept of cooperation in defense procurement could work in a realistic sense only if the European nations operated on a united and collective basis. Accordingly, the Congress encourages the governments of Europe to accelerate their present efforts to achieve European armaments collaboration among all European members of the Alliance.

Thus, the new statute breaks important ground in terms of legislative support for measures designed to promote standardization and interoperability. It strengthens the hand of the Secretary of Defense in waiving, when appropriate, the "Buy American" provisions. It provides explicit and positive support for the concept of licensing and co-production agreements among NATO members. And it directs the Secretary of Defense to identify areas for such cooperative arrangements and to negotiate such agreements in the interest of making progress toward standardization and interoperability in NATO.

Other Congressional Activities

There have been several other reflections of Congressional interest in standardization and related issues. At the direction of Senator McIntyre, Chairman of the Armed Services R&D Subcommittee, Mr. Hyman Fine, of the Subcommittee staff, undertook annual visits to NATO Europe during the past three years, in support of cooperation, standardization, and interoperability. The report of his most recent visit, in the fall of 1975, contains these statements:

> In the United States, there is a visible and growing awareness and participation by industry in European cooperation .... Industry, labor and the taxpayer all will benefit from the avoidance of unnecessary US Government spending on development of new equipment which our European partners already have developed. The adoption of European developed hardware by the United States is accompanied by licensing to US companies and provides US industry with sales and US labor with work .... There is a need for greater understanding by US companies, by labor, and the public that these arrangements are advantageous to the United States (Ref. 8, pp. S22764).

This statement by a knowledgeable, senior Congressional staff member, reflects substantial sensitivity to the basic issues involved in licensed production.

On March 31, 1976, Senator McIntyre chaired a hearing on European defense cooperation, with participation by key officials of the Departments of State and Defense, and also with the unprecedented participation of a group of parliamentarians from several European NATO countries. During this hearing, Senator Nunn cited the US Army's decision to procure the Belgian machine gun (MAG 58) as a significant departure from a traditional tendency in the United States to equate standardization with "Buy American" (Ref. 9).* It might be noted here that today, "standardization" has almost become synonymous with <u>waiving</u> the "Buy American Act," in the interests of the two-way street.

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* During this same hearing, Senator McIntyre asked the DoD representative, Gen. Bowman, if the DoD needed any legislative action to encourage or facilitate US participation in NATO standardization. Gen. Bowman indicated that there was a need for legislation that would permit the procurement of specialty metals produced outside the United States when such procurement is necessary to comply with agreements with foreign governments which require the United States to offset sales by the Department of Defense and where such procurement is necessary to comply with agreements in furtherance of the standardization and interoperability requirements within NATO. It is understood that progress is being made toward the enactment of such legislation.

Finally, in its report on the FY 1977 Military Authorization Bill, the Senate Armed Services Committee went on record as acknowledging and emphasizing "the important role that legislators must assume" in helping to find solutions to the problems of cooperating with our NATO allies in moving toward rationalization, standardization and interoperability (Ref 10, p. 109).

Possible Limitations on Congressional Support

A note of caution is in order, however, as regards the depth and durability of support in the Congress for standardization in general, and for licensed production in Europe in particular. Few senators were actively engaged in the effort to legislate a strong NATO standardization policy. There has been no recent indication of interest on the part of the Senate Foreign Relations Committee in the foreign policy aspects of NATO standardization. And as noted above, the House did succeed in injecting into this year's Military Authorization Bill some language that was presumably intended, at least implicitly, to discourage the waiver by the Secretary of Defense of the provisions of the Buy American Act. A majority of the members of both Houses may support standardization as a generally laudable concept, so long as there are no specific pressures against it, based on domestic economic and political considerations. There may be a need for broader understanding within the Congress of some of the implications of the use of licensed production as a vehicle to promote standardization. In general, when a US firm is a licensor, the "Buy American" issue does not arise. Furthermore, when a US firm is a licensee, the US gets some jobs it might not otherwise have obtained.

The House Armed Services Committee concluded its Aug-Sep 1976 review of the US-FRG tank harmonization program with the following resolution:

> (1) That, while it fully supports the underlying goal of standardization which prompted the addendum to the Memorandum of Understanding with the Federal Republic of Germany (FRG), the committee regards the decision-making time-table prescribed in that addendum as

premature and potentially in conflict with the overriding objective of the XM-1 program which is to field the most cost-effective main battle tank at the earliest possible date, and

(2) That it is the position of the Committee that that overriding objective of the XM-1 program must take precedence over secondary objectives such as standardization or interchangeability of components.

Another example of Congressional reluctance to permit US procurement abroad was the effort by Representative Conte to amend the Transportation Department's Appropriation Bill to prohibit selection of foreign built aircraft for the Coast Guard (Ref. 12, p 16).

Recent discussions in both Houses indicate the concern of members of Congress when a constituent firm "loses out." The current case involving a protest by the Maremont Corporation of Maine to the General Accounting Office over the US Army's proposal to buy the MAG 58 machine gun from Belgium reflects the kind of opposition that can be expected to be expressed by "losing" firms when the US Government undertakes to obtain a foreign developed or foreign produced defense item in the interests of standardization. In this connection, Senator Muskie, in Senate discussions on May 26, 1976, sought assurances from Senators Culver and Nunn that the then pending Standardization Amendment was not intended to apply retroactively to the MAG 58 case. Such assurances were provided (Ref. 13).

Appraisal

It is probably fair to conclude that there may be substantial latent opposition in the Congress, and particularly in the House of Representatives, to moving very far or very fast with NATO standardization. Such opposition may be based on a generalized autarkic concern for maintaining the US production base, on uneasiness about possible loss of US jobs, and on anxieties about balance of payment implications (Ref 14). Given this context, it seems reasonable to suggest that no major new initiatives in the NATO standardization field should be expected to surface in the Congress in the near future. If the US Government's efforts toward standardization are to be sustained, the Executive Branch

will have to exercise increasing leadership. But the central fact remains that the Congress is now formally on record in favor of NATO standardization efforts, in favor of waiving the "Buy American Act" provisions in the interest of standardization, and in favor of action by the Secretary of Defense to negotiate agreements for licensed production within NATO.

EXECUTIVE BRANCH POLICY DEVELOPMENTS

Like the Congress, the Executive Branch of the United States Government has long been on record in support of standardization and interoperability in NATO. President Truman records that, when NATO was being created, one of the potential Alliance benefits specifically emphasized by the United States was the reduction of "overlapping production by standardizing weapons and materiel" (Ref 4, p. 8). Speaking at the Heads of Government meeting of the North Atlantic Council in Paris on December 16, 1957, Secretary of State Dulles said "we suggest that the Council may desire to initiate in Europe a coordinated program of research, development and production of a selected group of modern weapons systems" (Ref 4, p. 21). During the past two years there has been an intensification of Executive Branch interest in NATO standardization in general and in licensed production in particular.

At the December, 1974 NATO Ministerial Meeting, the Secretary of Defense made a strong plea for more attention to NATO's rationalization efforts, emphasizing the benefits that could be derived from international cooperative programs (Ref 15). On 15 February 1975, the Assistant Secretaries of Defense for International Security Affairs and for Program Analysis and Evaluation sent a joint memorandum to the Military Services and to other DoD elements concerned, designed to coordinate DoD efforts in support of rationalization and standardization in NATO. The memorandum called for reports on the various initiatives then in progress and scheduled a review designed to assist in the formulation of DoD's future rationalization and standardization strategy (Ref 16).

First Annual DoD Report

On April 28, 1975, the Secretary of Defense submitted the first annual report to the Congress on the standardization of military equipment in NATO (Ref 5). This report marked an important confluence between Congressional and Executive Branch efforts in the standardization area. The report indicated that:

> Through properly structured programs of co-production of US equipment, and through utilization of selected defense items from European developments, we should be able to strengthen NATO's capabilities and deter further duplication of defense equipment.

The report also indicated that it was DoD policy to:

- Continue to emphasize weapons standardization in appropriate multilateral and bilateral contacts within NATO.
- Increase the emphasis on achieving interoperability.
- Increase the direct involvement of NATO Ministers of Defense and Foreign Affairs in standardization and interoperability.
- Seek new avenues and incentives for cooperation between government and industry in the United States and in other NATO alliance countries.
- Continue to seek expanded Congressional and parliamentary support.
- Obtain more broadly based involvement and support by the three military Services in the United States.

State-Defense Colloquium

On 9 May 1975 the Departments of State and Defense jointly sponsored a colloquium on the subject of implications for US foreign policy and industry of standardizing military equipment for NATO. Mr. Ellsworth, then Assistant Secretary of Defense for International Security Affairs, pointed out that DoD views standardization as a means of reducing the unit cost of weapons, increasing Alliance military effectiveness, and improving cost effectiveness through structured

competition rather than by dividing up the market. Mr. Robert Basil, Assistant Director for International Programs, Defense Research and Engineering, in describing DoD policy on standardization, stressed the importance of selectivity in cooperative programs, i.e., choosing areas of development where European technology is strong or where sharing our technology would have cost-effective benefits for the US and NATO. He also pointed out that at present the US produces a large segment of NATO and other Free World military equipment needs and that any significant reduction in US production would have to be viewed in light of its impact on our present technological and industrial base, employment and market, all of which contribute significantly to the fulfillment of our current role in world affairs. He noted, on the other hand, that it is also in the overall Alliance interest to sustain a healthy European technological and industrial base. Consequently, US approaches to our Allies on standardization should be made with full consideration of the dual objectives of US and European technological and industrial strength (Ref 17, pp. 4, 32-33).

NATO Summit Statement

The first top level Executive Branch policy statement on standardization and related issues in many years came in President Ford's address at the NATO Summit on 29 May 1975. The President's statement included these points:

> A generation after its creation, the alliance wastes vast sums each year, sacrificing military effectiveness. We have simply not done enough to standardize our weapons. We must correct this. We must also agree among ourselves on a sensible division of weapons-development programs and production responsibilities. And we must do more to enhance our mutual capacity to support each other both in battle and logistically. The pressures on defense budgets throughout the alliance should by now have convinced each of us that we simply must rationalize our collective defense.
>
> We must make more effective use of our defense resources. We need to achieve our longstanding goals of common procedures and equipment. Our research and development efforts must be more than the sum

> of individual parts. Let us become one in our allocation of defense tasks, support and production [underlining added] (Ref 18, pp. 514, 515).

US Standardization Initiative in NATO

Following up on President Ford's call for action, the Departments of State and Defense developed an approach to promote NATO agreements in the standardization area. By July 1975, the bases of US policy on standardization and interoperability of military equipment were identified, essential elements for a successful standardization effort were outlined, ongoing standardization activities were reviewed, and a program of action was developed. As the US policy was developed, emphasis was placed on the importance of French participation in the work on NATO standardization and on focusing effort at the North Atlantic Council level, in order to stress the political importance of standardization.

The US initiative in mid 1975 had envisaged a committee on standardization and interoperability, reporting directly to the North Atlantic Council, which would develop a statement of principles on standardization and lead to a concrete NATO plan of action.

However, the European members of NATO favored a more gradual approach and expressed the need for more time to get themselves organized. Accordingly, it was decided to establish, as an interim step, an Ad Hoc Committee on Interoperability. This Ad Hoc Committee and its five Working Groups have been active since the Spring of 1976.

Thus the outcome of the US initiative was somewhat more modest than what had initially been envisaged by the United States. But in gearing up for the 1975 discussions in NATO, the Departments of State and Defense made substantial progress toward forging an integrated policy approach, and that approach included considerable attention to the subject of licensed production.

Defense Department Policy Directives

Meanwhile, a series of significant policy directives on standardization, some affecting licensed production, had been issued by the Department in November 1975. On 8 November the Secretary of Defense

published a directive to his principal subordinates entitled, "NATO Rationalization/Standardization Charter," which prescribed functional responsibilities for NATO rationalization/standardization activities within the Department of Defense (Ref 19). It established a DoD Steering Group on NATO Rationalization/Standardization, headed by the Assistant Secretary of Defense for International Security Affairs.

Also on 8 November 1975, the Secretary of Defense issued a formal directive entitled "Basic Policy for NATO Weapon System Standardization" (Ref 20). Highlights from this policy directive include the following:

- The United States recognizes the desirability of greater standardization and interoperability of weapon systems within NATO and that the achievement of this goal requires a two-way street of cooperation with the Allies.
- A single production source may be unwise since production could be vulnerable to local economic factors as well as sabotage and military attack. From a political standpoint, single source production could fail to ensure the necessary public support for defense needs in non-production countries.
- Increased standardization will entail the procurement of equipment for NATO forces from both sides of the Atlantic. The European members of NATO have a legitimate interest in seeing their defense industries benefit from the increased markets standardization will bring.
- The members of the Alliance should seek agreement on complementary schedules for new weapons development and production, making appropriate adjustments in their individual replacement schedules as necessary.
- It must be clear from the start that winning a research and development competition does not necessarily mean a monopoly on production. In some cases there will be co-production or production with license and royalty fees on fair and reasonable terms. This co-production should considerably reduce the perception of national economic risks resulting from standardization and thereby make it easier for countries to accept each other's R&D products. Co-producers must

ensure that systems are interoperable with and as similar as possible to each other.

On 13 November, the Director of Defense Research and Engineering sent a memorandum to the Secretaries of the Military Departments which included the following guidance:

> We must ensure that, in the weapon system acquisition process, we (1) avoid requirements rigidity that unnecessarily precludes consideration of systems developed by our Allies, (2) give full consideration to the use of NATO Allies' systems, or modified variants thereof, in competition with US system development programs, (3) design US systems to be interoperable or interchangeable with those of our NATO Allies to the greatest degree possible and practical, and (4) seek methods by which NATO Allies will be encouraged to agree to US solutions (e.g., through co-production opportunities) when appropriate. (Ref 21)

Thus, by the end of 1975, the Department of Defense, in close cooperation with the Department of State, had established formal coordinating mechanisms for dealing with NATO standardization problems, and had elaborated policy guidelines on standardization that reflected substantial emphasis on licensed production.

Second Annual DoD Report

On 31 January 1976, the Secretary of Defense submitted the second annual Report to the Congress on Rationalization/Standardization in NATO (Ref 6). In an introductory statement, the Secretary said

> Our tentative view is that the Allies should eventually move toward competitive prototyping to ensure cost-effective weaponry, common selection procedures, sharing of production rights to selected systems, production of standardized equipment on both sides of the Atlantic, and freedom to use standardized equipment in foreign assistance programs. Such measures would help greatly to make the sharing of defense production between America and Europe a genuine two-way street.

The Report also presented a statement of "Possible Elements of an Allied Policy for Standardization of Weapons," which included the following points:

- Basic Alliance policy for standardization should protect legitimate national economic interests while providing weapons at a cost that allows them to be bought in sufficient numbers to meet Alliance defense needs.
- The most appropriate time to introduce commonality of weapons is when NATO members make their initial decisions on R&D procurement.
- Participants in competitive development of a weapon system could be individual companies or multinational (intra-European as well as European/North American) industrial teams.
- A generally acceptable solution for producing a system designated as standard would be to license, either in the private sector or government-to-government, a production capacity on both sides of the Atlantic. Although this would generally result in somewhat higher costs than single-source production, it would have several advantages:
  - It would spread the economic benefits of production throughout the Alliance.
  - It would transfer technology to the other producers for use in follow-on or spin-off projects.
  - It would provide for the survival of a production base in case of hostilities.

  All of these factors would make agreement on a standard system more likely.
- The cost of licenses to produce the standard system should include only a minimal or no R&D recoupment charge for countries who participated in the competitive development phase. The licensing cost of a standard system should be low enough to remove economic justification for developing a competing national product.

- The ability to supply weapons to NATO and certain non-NATO countries is an important political and economic factor in the decision of many governments to develop and produce a given weapon system. Production arrangements must permit sale of a NATO standard system in accordance with appropriate security agreements.

Hearing on European Defense Cooperation

As indicated earlier, a major Senate Hearing on European Defense Cooperation was held on 31 March 1976. The following excerpts of statements by Executive Branch officials provide indications of trends in US policy on standardization, and specifically on licensed production:

- Mr. James E. Goodby, Bureau of Politico-Military Affairs, Department of State -

  > ... we are now more aware of strong European feelings that Europe must strengthen its competitive capability in order to insure what Europeans consider an equitable share for Europe of weapons systems being selected for standardization within the Alliance.... Some countries have been interested in third country sales because the resultant longer production runs can reduce the unit cost of weapon systems to their own armed forces and help maintain a vital export market (Ref 9, pp. 25-27).

- Dr. Malcolm R. Currie, Director of Defense Research and Engineering -

  > Within the Department of Defense we must ensure that we avoid requirements rigidity that unnecessarily precludes consideration of systems developed by our Allies; that we give full consideration to the use of NATO Allies' systems, or modified variants thereof, in competition with US system development programs; that we design US systems to be interoperable or interchangeable with those of our NATO Allies to the greatest degree possible and practical; and that we seek methods by which NATO Allies will be encouraged to US solutions when appropriate (Ref 9, p. 31).

- Major General Richard E. Bowman, Director, European Region, Office of the Assistant Secretary of Defense for International Security Affairs -

> ... members of this Alliance will be willing to standardize most systems only if there is licensed production in more than one country. Of course, this approach also has the military dividend of alternate sources of supply in the event of conflict.
>
> ... even after we agree on licensing of production as a means of increasing standardization, many members of the Alliance will find it difficult to insure an objective hearing for foreign programs....
>
> In the licensing process, as we found out in Roland, we have problems. We could not read the drawings.... Now, we do not feel that this proves that licensing will not work, and we cannot have standardization. We feel however that we must learn these lessons and come up with the procedures which will help us beat this in the future....
>
> We feel that cross-licensing is already an important approach in increasing NATO standardization and the "two-way street" concept. The F-16 and ROLAND programs are key examples.
>
> ... This kind of licensing approach is relatively new in the Alliance's history, but it is an approach which has considerable potential for solving our long-standing problem of how to achieve NATO standardization [underlining added] (Ref 9, pp. 154-158).

Appraisal

Recent developments in the evolution of Executive Branch standardization policy have focused growing attention on licensed production. Increasing US awareness of the need for reciprocal sharing of the benefits of defense production points naturally toward

some kind of cooperative production arrangement, and licensed production appears to be the best available device. It is noteworthy that growing interest by the Departments of State and Defense in grappling with the problems associated with licensed production has coincided with Congressional action formally encouraging the Secretary of Defense to negotiate agreements for licensed production in NATO. It seems likely that when active consideration of the tougher issues of standardization is resumed in the North Atlantic Council, licensed production will figure prominently in the Council's deliberations.

INDUSTRY VIEWS

The discussion that follows is based on informal interviews with a sample of representatives of the American defense industry who are knowledgeable about licensed production possibilities and problems. The views expressed do not necessarily reflect official positions of specific firms, but they do represent responsible opinions of informed individuals. Time available for this study did not permit an extensive, systematic survey of industry views.

A typical general reaction of many industry representatives to the idea of licensed production was a strong insistence on the merits of "making and selling our own product—we can do it best." This implies a kind of built-in opposition or resistance to cooperative production arrangements and an almost fervent support for the free market and open competition approach. Consonant with this rather widely held view was a comment that the United States may be "paying a high price for the principle of NATO standardization."

But there also appears to be growing awareness in industry that the character of the world economy has changed so drastically in recent years that it is no longer realistic to think in terms of an assured, preeminent US position in the international market. The fact is that effective competition has emerged abroad. Demands for offsetting

purchases or other compensatory advantages are now a part of nearly every US effort to sell to NATO nations. Heavy foreign government involvement in international commerce in defense products further restricts opportunities for exploiting US industry's desires for open competition. In these circumstances, there is growing awareness in industry that what are regarded as inherently undesirable practices—such as licensed production—may have to be tolerated. As more than one representative of industry put it, half a cake is simply better than none. Some interviewees expressed the positive belief that licensed production is a desirable approach; one even described it as "the wave of the future."

Some Pros and Cons of Licensed Production

The principal arguments advanced in favor of licensing were these:

- Over the long haul, total production is likely to be greater, with consequent greater profits for participating industry.
- The licensor gets not only fees and royalties (which help the balance of payments), but a good prospect for related sales of parts, sub-components, engineering services, or other items. One interviewee indicated that it would not be unusual for a US licensor to "get back" between 1/3 and 2/3 of the total value of the deal.
- Licensed production can provide a highly effective means of transferring complex technology. Mention was made of the value of the "hands on" process in the licensee country.
- In the licensee country, it can permit production to start sooner than if in-country development had to be awaited.
- A technology lead is perishable, so it is better to license out a product, even if the return is small, than to have some other country "catch up" and thus lose the deal entirely. (One comment: "A share of something is better than all of nothing.")

The principal arguments advanced against licensed production were these:

- It can create future competitors.
- It means higher unit costs.
- There are serious risks of excessively high start-up costs in setting up short production runs, particularly if there is no possibility of converting to alternate production of some kind.
- It can greatly complicate the third country sales problem.
- It can introduce a formidable series of practical problems, such as language differences and the need for technical translators, "non-homogenous drawing techniques," differences in measurement systems (although most interviewees concluded that this is not a major problem), differing safety standards, materials standards, testing standards, auditing procedures, export control regulations, industry structures (e.g., extent of government ownership and control, European emphasis on stable employment, European industry's reluctance, for economic reasons, to operate more than one shift), differences in national requirements (e.g., US non-NATO military needs), and differences in tax laws and other control measures.

Those who tended to look favorably on licensed production agreed that the problems enumerated above are substantial, but they generally tended to regard them as manageable—as something to be lived with in the real world. They also tended to favor steps by the US Government to reduce these difficulties. In this connection, some interviewees expressed the judgment that it would be desirable to try to develop guidelines for licensing; most seemed to consider this impracticable, believing that licensed production arrangements would have to be worked out on a case-by-case basis, in any event.

Views on Congressional Approaches

There appears to be a considerable degree of awareness within the industrial community of recent Congressional actions affecting standardization in general and licensed production in particular. Reactions ranged from the view that "waiving 'Buy American' is the wrong way to go" to the judgment that this year's standardization legislation is balanced and prudent. A view was expressed that there are probably elements in the Congress who favor standardization because they believe improved effectiveness may permit a reduction of US forces in Europe, with consequent budgetary and balance of payments savings.

Other Comments

The following are typical of other noteworthy comments made by industry representatives:

- The current US Government push for standardization appears to be sufficiently serious to warrant industry's "watching it closely." Incidentally, there were surprisingly few specific suggestions for changes in US Government policy or approaches.
- Government control over the export of sensitive technology is important to US industry; the United States should guard its "high technology" carefully.
- There is a need to reduce bureaucratic delays in processing projects. It was pointed out that the French in particular can sometimes move much faster than we do.
- There is a need for bona fide agreement on the meanings of such basic terms as "standardization" and "interoperability;" people now "talk past each other" because words mean different things to different people.
- Standardization is fundamentally a problem of distribution of technology; licensed production is a feasible and effective way of accomplishing this distribution.

- There is a need to reach agreement early in the weapons procurement process (agreement on specific requirements) if standardization is to be achieved.
- There is a need for effective configuration control, to limit the extent of changes that can be made in a licensed product.
- Standardization must not be allowed to "freeze technology in place." Licensed production arrangements must make adequate provision for exchange and upgrading of information.
- More consideration should be given to working out offsets in nonmilitary areas.
- There is a useful role for international supervisory/management entities (such as NADGECO) for bridging the gap between governments and separate firms engaged in carrying out complex technology transfer projects, particularly if more than two governments are involved.
- There is a need to educate organized labor on the proposition that licensed production does not necessarily mean an export of jobs; it may mean more jobs in the long run.
- Trans-Atlantic R&D collaboration is harder to work out than licensed production. It is very difficult to get agreements between nations on operational requirements, and different countries have differing development and procurement philosophies. At the same time, the RDTE process is becoming so very expensive that economic pressures for collaborative R&D seem sure to grow.
- NATO European nations support standardization largely in the hope of getting more sales.
- The US military services are the biggest single obstacle to standardization, because they are strongly biased in favor of US equipment.
- The ROLAND II is a highly important pilot project, with significant potential for influencing the future course of licensed production in NATO.

Appraisal

On balance, it appears that there remains a rather widespread view within American industry that licensed production arrangements are inherently unattractive. But there also appears to be a growing realization that the almost instinctively preferred "make and sell our own product" approach is becoming increasingly nonviable. Accordingly, the trend seems to be toward broader acceptance—albeit in some cases reluctantly—of licensed production as a matter of economic necessity. It appears reasonable to speculate that industry's interest in licensed production and in trying to find better solutions to the problems associated with it will grow in the months and years ahead.

CONCLUDING OBSERVATIONS

During the past two years, there has been a marked intensification of interest and activity in the United States related to standardization in NATO. A major theme running through discussions of ways to promote standardization has been the emphasis on the changed character of the international, and especially the intra-NATO, arms market. The former dominant US position as producer and seller of military equipment is being challenged effectively by Western European competition. Thus, when discussion turns to standardization of weapons in NATO, it no longer follows automatically that this means essentially standardization on US weapons. European NATO nations are increasingly insistent on a share of the benefits of defense production as a precondition of their participation in Alliance standardization efforts. This insistence has been a factor in the growing appeal of licensed production as a vehicle for harmonizing US and NATO Europe's interests in moving toward standardization.

In the United States, the Congress has been actively and constructively engaged in considering the underlying policy aspects of the standardization problem and has taken major legislative steps designed to strengthen the legal basis for US standardization efforts.

There may be some question concerning the depth and durability of Congressional support for standardization in general or for licensed production in particular. But the central fact remains that the Congress has formally subscribed to the desirability of standardization and interoperability of NATO equipment, and has endorsed licensed production as a useful technique for achieving US objectives in this area.

Meanwhile, activity in the Executive Branch has included President Ford's strong statement in support of standardization and cooperative production at the NATO Summit Meeting in May, 1975; a State-Defense Colloquium on the implications for foreign policy and industry of standardizing military equipment for NATO; a major US initiative in NATO during 1975 on the standardization issue; and considerable effort devoted to improving intra-governmental machinery for coordination of standardization activities and to elaborating Executive Branch policy views. These views have been reflected in DoD reports to the Congress, in State-Defense instructions to the US Mission to NATO, in policy directives issued by the Department of Defense, and in testimony by State and Defense Department officials at a major Senate hearing in March 1976. A central feature of Executive Branch actions has been a growing recognition that carefully devised licensed production agreements can make a major contribution to NATO military standardization while taking into account purely national concerns about R&D, employment, and markets for weapon sales.

Activity within the US Government has been mirrored to some degree by growing US industry concern over the implications of increased emphasis on NATO standardization and on cooperative production arrangements. The defense industry as a whole probably retains a strong instinctive preference for producing and selling in open competition. But in a political-economic climate that is reflected in the phrase "co-production or no sale," many US firms are accepting the stark

proposition that cooperative production agreements offer at least an opportunity to share in the market, with the alternative being no share at all. Thus, there are indications within US industry of willingness to settle for licensed production and readiness to tackle the problems associated with devising effective licensed production arrangements.

The overall trend in the United States definitely points toward increasing reliance on licensed production arrangements and to the need for actions to reduce the not inconsiderable obstacles that stand in the way of optimum use of licensed production as a device for promoting standardization and interoperability in NATO.

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Chapter 3
PATTERNS OF LICENSED PRODUCTION AND CO-PRODUCTION

The purpose of this chapter is to identify, first, the general patterns of licensed production and co-production in NATO and, second, any common issues and the lessons deriving from them for future US policy. A wide spectrum of licensed production and co-production agreements and arrangements from the late 1950s to the present was examined. Details of illustrative agreements and arrangements are presented in Appendix A. The patterns, issues, and lessons these present are synthesized in this chapter.

PATTERNS OF LICENSED PRODUCTION

Although newly promoted as a device for achieving weapons standardization or interoperability within NATO, licensed production and co-production have had a long history in NATO. Patterns can be distinguished in this history largely on the basis of the type of system in question, the urgency of the military requirement for it, the technological capability of the user to develop and produce the system, and the costs and industrial consequences of independent development and production. In terms of these variables, four broad patterns can be identified. In the order of historical occurrence, with most continuing to this day, they are:

1. Ad hoc adoption of an ally's system. (The ad hoc adoption and licensed production of another country's proven system by either the United States or a European ally to meet a specific immediate requirement.)
2. Transfer of US technology to Europe. (Promotion and adoption of licensed production to effect

transfer of US technology and to support allied industrial strength.)

3. Co-development and co-production. (Pooling of resources and co-development of a complex system by two or more NATO partners, followed by co-production or licensed production of component elements.)

4. Competitive common selection. (Licensed production or co-production undertaken to facilitate common selection and procurement among competitive systems.)

While more than one of these patterns can exist at the same time, the patterns do reflect changes in the technological balance between the North American and European elements of NATO. The relationship of the patterns to the technological balance is sufficiently important for future US policy that the four patterns constitute a logical as well as historical basis for the organization of this chapter.

Throughout NATO's licensing experience there have been several major recurring issues. These include: (a) information-sharing between licensor and licensee, including questions of proprietary data, flowback and security; (b) work-sharing between licensor and licensee and among licensees if there are more than one of the latter (Work-sharing can include participation in R&D as well as production.); (c) the market for third country sales, either to other NATO partners or outside NATO (The licensor might limit the licensee's right to make such sales either because of fear of economic competition or for political or security reasons.); (d) differences in design philosophy, technical procedures and standards of production.

These factors vary according to the technological balance and the bargaining positions of the nations involved. For example, in pattern 2 the European Allies were grateful for any production or stimulus to military R&D they could get. They could not logically expect either any form of co-development on one hand or extra-NATO sales on the other. By the time the growth in European technology had made possible pattern 3, however, many of the same nations could rationally choose to develop and produce their own designs and seek to recoup their expenditures in the NATO or world armaments market.

PATTERN 1. AD HOC ADOPTION OF AN ALLY'S SYSTEM

General

The first pattern arises where one nation's technology lags in a particular field rather than in military technology generally. That nation decides that for reasons of time or alternative requirements for resources it does not wish to make the technological effort necessary to develop a desired weapon system. It is willing to give up any possibility of third country sales or at best to have this option sharply defined. In contrast to pattern 2, however, the licensee in this pattern might well have been able to carry out the project as well as or even better than the licensor. Several of these cases have concerned US licensing of production from European Allies who were below the general level of US technology. Also, some European licensing from the US has involved specific systems in areas where the Allies had considerable capability of their own or even a technological lead.

US and European Cases

A representative list of cases in this ad hoc pattern illustrates the flexibility of licensed production. Several US decisions were taken in the hope of satisfying immediate needs. During the Korean War, the United States bought two British B-57 Canberra aircraft with the intention of bypassing usual development time and US design criteria and producing an American version very close to the original. In the early 1960s the US Navy decided to upgrade its existing gun fire control systems by Americanizing a Dutch system that had been built around a NATO specification. During the Vietnam War, the US Army tried to fulfill an immediate combat need by using Expedited Non-Standard Urgently Required Equipment (ENSURE) procedures to acquire production rights to the French AN/TPS-58 radar system (See Appendix A).

Two more recent cases reflect a longer-term American desire to capitalize on particular strengths of European Allies. Beginning in 1969, the US Marine Corps recognized British preeminence in V/STOL aircraft and has since purchased over 100 AV-8A HARRIER planes directly from Hawker Siddeley. From 1972 through 1975 the US and UK were co-developing an

advanced HARRIER. When the British abandoned this project and put their efforts into a more modest modification of the original aircraft, the two nations agreed to continue information exchange and the US planned for unilateral development of the advanced AV-8B. The conclusion to the binational effort is the possibility of British co-production of the AV-8B once it has been developed (Ref. 1, p. 17). The second case is that of the ROLAND short-range air defense missile. The 1974 Army decision to acquire this French-German system under licensed production marked a recognition that there was a void in the US arsenal that a European weapon could fill.

On the European side, the British decided in 1964 that licensed production of the F-4 PHANTOM would be less expensive than continuing their own TSR-2 project. Forced by costs to abandon across-the-board development of the full range of military aircraft, they chose to maintain production lines as well as an advanced R&D capability in the specific areas of engines, radar and controls. Under very different conditions a German government that was expanding its aircraft industry selected the Sikorsky CH53-G medium transport helicopter to avoid a heavy R&D commitment in this field (See Appendix A). The Germans decided that they could take advantage of the particular areas where the United States led European helicopter manufacturers and use competition between two US firms to gain the information necessary for their own future efforts.

Difficulties

These ad hoc projects faced several difficulties. Some of the projects were hindered by legal restrictions and differences in design and standards of production. The French and German firms that had developed the AN/TPS-58 followed European legal practice and did not pass on their proprietary data as a US firm would have done. More important, the cases of Canberra, MK-87, AN/TPS-58 and ROLAND have revealed major differences between European and American design, drawings, technical procedures, tooling, and standards of performance, safety and maintenance. In all of these situations American firms found difficulty in producing the European systems. In several cases US companies resorted

to more "Americanization" than at first had been intended. The result was to slow production of the final system and to hamper progress toward standardization. However, some of the difficulties could be attributed to weaknesses in US industry that DoD had not sufficiently considered before its decisions (See Appendix A; Ref. 2).

These projects were relatively successful from a purely national viewpoint but of mixed outcome in terms of standardization. Most of the technical difficulties eventually were overcome so that the system did become a part of the licensee's inventory. On the US side, Sperry Rand produced a modified version of the MK-87 in 12 to 18 months less than it would have taken to develop and produce an all-US unit. The US Army re-engineered some of the components of the AN/TPS-58 radar on the basis that this would be less costly than purchasing the proprietary data from European firms. ROLAND is being adapted to American use, and the licensees, Hughes and Boeing, have worked out agreements on information exchange and flow-back with Aerospatiale and MBB. Even in the most difficult situation, that of the Canberra, an Americanized unit was finally produced and put into operation.

In the European cases, the British manufactured 170 of an orignally projected 292 F-4s. They were presumably willing to sacrifice the larger output in order to ensure the admittedly expensive use of the Rolls Royce engine in the aircraft. German co-production of the CH-53G helicopter seems to have proceeded without any major problems. If a nation is willing to bear the expense and at times the uncertainty of co-production of a system designed and developed according to foreign standards, this method often can be an effective means of filling a gap quickly. It offers the great benefits of timeliness and flexibility.

Implications for Standardization

This pragmatic and national focus meant that several of these projects contributed less to standardization than might have been expected. In most cases the licensee countries were almost exclusively concerned with meeting their own immediate military and economic needs. They made what they considered necessary adjustments in the original system with

little concern for its role in the total NATO defense posture. Defense ministers conceived these projects in completely different terms from the STARFIGHTER and the offensive and defensive missiles of pattern 2. The Canberra, MK-87 and AN/TPS-58 were necessarily Americanized in such a way as to destandardize them from the original British, Dutch and French versions. Plans for the advanced HARRIER were adopted by the United States precisely because the British had decided to abandon the project, and no other Allies had moved into that void. In Europe, the British chose the F-4 in order to maintain production lines and specialized R&D capability. They were quite willing to tolerate modifications of the original US and the directly-purchased German versions and to accept the fact that their variant could not be repaired on American or German airfields.

Despite these developments, the ad hoc pattern of licensed production does offer some encouragement as a means of furthering standardization. Both American and German officials involved in the CH53-G negotiations considered NATO standardization to be one important goal of this project. In contrast to the case of the British F-4, for example, the Germans accepted the original US engine and had it built by the Munich firm MTU under license from General Electric. The ROLAND missile will be altered so that the US version is not completely interchangeable with the French-German original, but the two variants will remain interoperable in many respects.

Some changes may be inevitable in cases like these. If engineers are to remain involved in continued system development, they may insist on product improvement of individual weapons licensed for co-production. Such "Americanization" or "Europeanization" may not always contribute to increased military effectiveness, but it may be essential to maintaining an active R&D capability.

These successful cases point to the particular advantages of pattern 1 for standardization. The limited nature of the projects makes them much easier to initiate and carry through than those based on the major technology transfer of pattern 2 or the carefully planned co-development

of pattern 3. Since these projects are relatively independent of the overall American-European technological balance, they can be established whenever a target of opportunity presents itself. They provide the powerful incentive of filling an immediate gap in one's own capabilities without entering a major program or admitting to major deficiencies. So long as fundamental NATO goals compose at least one factor in the calculations of the governments involved, such projects offer an important incremental means of furthering standardization and halting de-standardization.

PATTERN 2. TRANSFER OF US TECHNOLOGY TO EUROPE

Background

This earlier pattern of licensing occurred when it was impossible for the European recipient to develop its own military technology to the necessary level. In such situations there was no choice except to rely on the capabilities of the US, then the most advanced member of the Alliance. Most of these cases occurred in the late fifties and early sixties in response to and under the impact of dramatic Soviet achievements in aerospace and military technology. In December 1957 Secretary of State Dulles proposed a "selective . . . pooling of talent, combining of resources, and sharing of research and development information." He committed the United States to "supporting the weapons base in Europe" through purchases for US troops as well as for military assistance (Ref. 3, p. 22). By the mid-sixties this initiative had led to the licensed production in Europe of nearly 1000 F-104G STARFIGHTERS and of more than 4000 HAWK air defense missiles, 5000 SIDEWINDER air-to-air missiles and 4000 BULLPUP air-to-surface missiles. A more limited project was the licensing of the M-113 armored personnel carrier to Italy alone.

This pattern of intentional transfer of US technology has had more long-term consequences than pattern 1. The transfer facilitated the development among European NATO partners of a sophisticated military technological-industrial base for long-term requirements as well as immediate needs.

Technology and Economics

Each of these cases witnessed a major flow of technology and production know-how from the United States to European companies or consortia. For example, the HAWK program saw the training of over 650 European technicians in the United States as well as many visits by European industrial and technical personnel to resolve particular difficulties. Some 250,000 manufacturing drawings were prepared by the United States for European use; vital US material was delivered to European factories; millions of production drawings were circulated in Europe (Ref. 4).

Production of this military equipment was spread throughout Western Europe. The participating governments sought to maximize both employment and inflow of technological knowledge. Each state also wished to maintain its balance of international payments and to ensure that it paid out no more than it received in contracts for its firms. The production of HAWK was directed by a consortium of five national prime contractors, which were the leading electronics companies in France, Germany, Italy, Belgium and the Netherlands. Separate assembly centers were set up in France, Germany and Italy, and over 60 European factories were involved in the project. SIDEWINDER involved one German prime contractor, 11 sub-contractors and 250 firms spread among Germany and seven of the smaller NATO nations. Even so there was objection that all the final assembly was performed in Germany (Refs. 4, 5).

Two-thirds of the BULLPUP production was concentrated in Britain, but the rest was distributed in Norway, Denmark, and Turkey; and the Norwegian government overcame economic and technical arguments to secure the prime contractorship for its firm. The F-104G was built by a consortium consisting of the major aircraft companies in Germany, Italy, Belgium and the Netherlands. A separate engine production program included firms from Germany, Italy and Belgium, and electronics work was spread throughout the four nations. Over 500 subcontractors were involved in the total project. There were four separate airframe production lines and three engine lines (Refs. 4, 5).

Licensed production of these systems cost more and took longer than direct purchase from the United States would have done. Bidding prices were normally established not through open competition but through negotiation with national prime contractors selected by each government. Balance of payments requirements restricted freedom of selection of subcontractors. There was duplication in production of subsystems because of national fears of losing out on valuable information and being left behind in future competition. Qualified personnel and facilities frequently were hard to find, and it was difficult to coordinate work that was widely dispersed. In some cases these difficulties led to as much as 50 percent of total procurement being made in the United States (Refs. 3,4,5). A leading defense analyst has argued that these programs of technology transfer did not make the most "rational" use of European NATO's resources (Ref. 6, p. 20).

However, each European nation considered its level of employment and its future R&D prospects to be as important as military efficiency in deciding on defense procurement. In the absence of a supra-national NATO organization, the costs noted above were a necessary requirement of widespread participation in the US-initiated projects.

Military Accomplishments

These weapons projects made two major contributions to European defense. First, they substantially strengthened the design and production capability of several nations in aircraft and missiles. The work on the STARFIGHTER allowed Germany, and to a lesser degree Italy, to begin to compete with Britain and France in aircraft; one economist has stated that F-104G participation "jumped European airframe companies 15 years ahead of their prior status" (Ref. 5, p. 17). The most striking current example of this increased capacity is the British-German-Italian Multiple Role Combat Aircraft (MRCA); another is the German-French ALPHA JET trainer/ground attack aircraft.

Involvement in HAWK, SIDEWINDER and BULLPUP gave European companies experience in missile technology. This has greatly aided development of the current generation of French, German and British air-to-air, air-to-surface, surface-to-air and antitank missiles. It also made possible the later-abandoned plan to introduce a European-developed low altitude target acquisition system into the Improved HAWK. This growth in European capabilities is discussed later in the present section as well as under pattern 3.

The US transfers to Europe also made important contributions to NATO standardization. Throughout the 1960s the F-104 remained the major fighter for all NATO members except Britain and France, although the European version was modified from the US original. The HAWK, BULLPUP and SIDEWINDER missile systems all followed Basic Military Requirements designated by SACEUR. Common production of the HAWK meant that a standard low altitude air defense system was adopted for all Central Region forces except the British. The follow-on Improved HAWK program increased the requirements on co-producers for quality and standardization according to the definitions of the licensor (See Appendix A).

The BULLPUP and SIDEWINDER were less widely adopted. BULLPUP was chosen by Britain, Norway, Denmark, and Turkey as well as by the United States; SIDEWINDER by only two major nations—Germany and the United States—among the nine co-producers. However, the selection of BULLPUP by five Allies did mean that the major NATO air-to-surface missiles were either this US weapon or the French AS-30 chosen by France, the UK and Germany. The SIDEWINDER became a standard weapon, whose current version, the infrared AIM-9L, is the subject of interest by all the European Allies except France.

These contributions to European defense were so timely and substantial that US Allies had no choice but to recognize their subordinate status in the arrangements. In most cases the Europeans played no role in R&D and simply took over systems designed to meet US requirements and specifications. The Germans did insist on major changes in the F-104, but they began with an American-designed aircraft and the

modifications were designed by the American contractor, Lockheed. In each case the European nations paid licensing fees to US firms, and they usually received no rights to third country sales. Total revenue to American companies on the F-104 may have been as high as $1 billion (Ref. 4, p 16).

Obsolescence of Pattern 2

The growth of European military technology has meant that since the mid-sixties this form of licensed production has been declining. The outspoken French opposition to standardization around American systems has been taken up more gradually and pragmatically by the other larger European states. The US lead has continued to be accepted on several programs that are derived from the original missile projects. Raytheon has been the directing company for the Improved HAWK and the SEASPARROW ship defense missile system. The AIM-9L will be co-produced by Germany, probably within a European multinational consortium patterned after those of the early sixties. However, these actions have been more than balanced by the evidences of European autonomy. The AIM-9L faced competition even from the standardization-oriented Germans until the latter agreed to stop development of its Viper missile. The British have modified the air-to-air US SPARROW (AIM-7E2) into the XJ-521 SKYFLASH, which they will use on their own F-4s and MRCAs and which is a possible candidate for American F-4s and the current F-14s, F-15s, F-16s and F-18s. In other fields of guided missiles the Europeans have developed their own systems in a way that would have been impossible 10 years ago. (See pattern 3 below.) Finally, the allies may not be able to compete with the American AWACS, but they can hardly be pleased by the fact that the largest NATO partner has offered them no R&D role and very little work-sharing on this project, which is designed solely for the defense of Central Europe.

The trend away from pattern 2 is best exemplified in the recent licensing agreement to produce the F-16 fighter. At first glance that decision appears to be a useful continuation of the pattern of US technology transfer. Standardization will be assured by the relatively rare use of a NATO standardization agreement (STANAG) on quality control.

Aid to selected European armament companies is evident in decisions to procure some European equipment directly and to produce in Belgium and the Netherlands 10 percent of the value of the projected 650 US Air Force purchases, 40 percent of the value of the 348 European purchases, and 15 percent of the value of the estimated 500 third country sales. Although General Dynamics has had difficulties in locating European subcontractors, these problems do not appear any greater than those in previous pattern 2 projects. The governing Multi-National Fighter Program Steering Committee is being assisted by US Air Force System Program Offices in Europe as well as in the United States.

From a different perspective, however, the F-16 case is the exception that proves the rule about the decline of pattern 2 licensed production. In contrast to the F-104 of 15 years earlier, the American plane faced serious competition from a European rival, the French MIRAGE F1. Even more striking, the co-producers and potential purchasers were reduced from the F-104 list, which included Germany, Italy and most smaller allies, to just the four smaller nations of Belgium, Denmark, the Netherlands and Norway. This means that the "low" portion of the US Air Force high-low mix was suitable only for strictly "consumer" nations - nations that were associated with the production of neither the first-rank French aircraft nor the British-German-Italian MRCA. Therefore, the agreement made at best a minor contribution to NATO-wide standardization.

The project has an even less helpful effect on the total European defense industry. The choice of F-16 over MIRAGE rewards American R&D and penalizes French R&D at a time when NATO is trying to draw French armaments production into closer relations with that of the rest of Europe. At least as serious was the decision to concentrate European co-production in Belgium and the Netherlands. This action missed the opportunity to strengthen the strategically important French armaments base and to show that a "losing" developer could become a participant in final production. It also bypassed the well-capitalized industries of Britain and Germany in favor of relatively small firms with little

capacity for long-term aviation production. The major European companies have criticized the F-16 decision on these grounds (See Volume III).

It is hardly surprising that the small consumer nations insisted on production in their factories. They could not be expected to equate the European aircraft industry with the interests of the three largest states. However, the F-16 case does offer an example of how American military sales and close relations with some NATO allies may conflict both with short-term standardization and with the long-run growth of the European armaments industry.

PATTERN 3. CO-DEVELOPMENT AND CO-PRODUCTION

Preconditions and Motivations

Pattern 3 developed when Europe emerged from its relative technological backwardness of the 1950s and began to compete with the United States. It has built on the experience in cost-sharing and work-sharing gained during the multinational programs of pattern 2. In pattern 3, two (occasionally three) European nations reject the temptation of technological autarky and pool their R&D and productive capacities to meet their military requirements. Some pooling was attempted with the US as in the US-FRG main battle tank (MBT-70) program, but on the whole this co-development and co-production pattern was distinctively intra-European and, in fact, began to compete with US technology and production. Unlike the dependency in pattern 2, the pooling nations do not need to rely on technology transfer from the United States or on large-scale multinational management organizations. Unlike the expediency in pattern 1, they decide that it is worthwhile to apply the resources they possess to the development of the desired system. This allows them to avoid the status of a mere licensee with its limitations on development experience and on any participation in third country sales.

In different terms, the initiating nations calculate that the political and economic gains from participation in the entire development-production-marketing sequence outweigh the cost in human and material resources. The motivation behind such decisions is well expressed in the 1969 British statement that the MRCA project pointed both to "economies

of scale" and to "maintain[ing] a European capability in some of the advanced technologies which may be vital to our economic welfare in the next decade" (Ref. 5, p. 22).

It is important to note that considerations of political prestige and presumed civilian spinoff from military technology are of crucial importance in such decisions. The projects that fall under pattern 3 often could not be justified solely in terms of immediate economic gain or military efficiency. This fact is often ignored by American analysts or government spokesmen who deplore from an "Alliance" perspective the lack of "rationality" in European armaments decisions. To many European leaders such objections represent at best a confusion of basic national goals with suboptimization and at worst an effort to preserve the relative technological balance of pattern 2.

The Range of Cases

Co-development began in European NATO in the 1950s with two projects of limited success. The G-91 close support jet fighter had an Italian airframe, British engine, French undercarriage and Dutch electronic equipment; it was produced in Germany and Italy. The Atlantic maritime patrol plane was developed by a consortium of major firms from Germany, France, Belgium, the Netherlands, and Italy. Both projects were overly ambitious and lost some of their initial sponsors during development and particularly when it came time for purchases.

Since the mid-sixties, however, there has been a series of important projects between pairs of major European allies. The British and French have co-developed the LYNX and GAZELLE helicopters and are co-producing these aircraft as well as the companion PUMA. The same two nations have also developed and are producing the JAGUAR ground attack/trainer jet; the UK is committed to purchase at least 200, France at least 150. In 1970 France joined Germany in development of the ALPHA JET trainer/ground attack aircraft. Each government will buy 200 aircraft, with deliveries to begin in 1977. There is similar activity in the field of missiles. The French have joined the British in development

and production of the MARTEL air-to-surface guided missile. They also have teamed with the Italians in the OTOMAT surface-to-surface naval missile. The most extensive collaboration has been French-German work on the KORMORAN antiship missile, the MILAN and HOT antitank missiles and the surface-to-air ROLAND. The American choice of ROLAND to supplement the US-developed CHAPARRAL was symbolic recognition that in a sophisticated military field European technology could now equal American. Much more limited collaboration has taken place in the field of naval systems and artillery. There is a current French-Belgian-Dutch minesweeper project. The British and Germans are co-developing a self-propelled (SP-70) as well as a towed (FH-70) replacement for the US-built 155mm howitzers, and there is a proposed Italian role in co-production (Refs. 4, 7).

Under these conditions, third country sales take on an importance that they could never have had in the projects of patterns 1 and 2. Both the British and the French export about half of their aviation output. Europe as a whole exports 50% to 60% of its production of tactical missiles. France and Germany expect major sales of the ROLAND and in their memorandum of understanding with the United States they retain the market in "all other NATO countries and all other countries except" those on a select list (See Appendix A). Additionally, the French and British have licensed the Gazelle helicopter in Yugoslavia (Ref. 7, p. 48).

MRCA

By far the most ambitious recent co-development effort has been the British-German-Italian MRCA. In 1969 the three nations agreed to develop a variable-geometry aircraft to perform interdiction/strike, close support and air superiority roles. The project has been administered through a NATO MRCA Management Agency (NAMMA) and through Panavia, an international company formed specifically for this purpose and employing an independent technical and management staff (See Volume III). The same attention has been paid to national claims on production as was the case in the multinational efforts of pattern 2. Approximately 350 firms will supply components, and at its peak the project will provide 70,000

jobs. Additionally, however, R&D opportunities have been allocated throughout the three nations in a way that was impossible when almost all relevant technology emanated from the United States. Finally, along with third country sales, there is the possibility of a production run equivalent to that of the F-104G. For these reasons MRCA development and production has continued despite large cost increases, problems in development of the engine and criticism that the aircraft marked no significant advance over the US F-111.

The continued trinational support of this project represents the coming-of-age of the European military aircraft industry. Two nations, Germany and Italy, who had joined Belgium and the Netherlands in co-producing the American F-104G now aligned themselves with the traditional European aerospace leader in development of a specifically European weapon system. The international firm, Panavia, is seeking further collaborative projects in military aircraft. In contrast, the most recent American aircraft offered to the NATO allies, the F-16, found willing co-producers in the two Low Countries but had little appeal to major "consumers" of the F-104 who had now joined Britain and France in the ranks of the "producers."

The MBT: Limited Success with a Controversial System

The development of a main battle tank for NATO has been beset by many difficulties and has only tentatively reached the goal of limited interoperability. German efforts to achieve some form of standardized tank go back 20 years. In the late fifties Germany and France decided to build competitive prototypes and to select the superior version for joint production. When the two nations found that they could not agree on design, the French went on to develop the AMX 30 and the Germans the LEOPARD 1. Meanwhile, Britain, with a proud and historic tank design and production capability, independently developed and produced its CHIEFTAIN. Germany then joined with the United States in the co-development of the MBT-70. This project was terminated in 1971 because of differences over tank doctrine and technology and rapidly rising production costs, and the two countries followed separate development programs for a replacement tank for aging inventories.

Impact on Standardization

Since projects combining co-development and co-production seem to be the most likely means of standardization in the near future, it is important to understand the particular nature of this form of standardization. These systems can best be seen as contributing first to interoperability and second to the prevention of destandardization. A major difference from most of the systems licensed under pattern 2 is the lack of complete interchangeability. Even while conducting joint projects, major European nations maintain and can afford to support different military requirements. The French and British models of the JAGUAR have substantially different avionics and weapons. The French version of the ALPHA JET is primarily a trainer, the German model primarily a ground attack-fighter. On the ROLAND missile system, France took delivery of the fair-weather-only ROLAND; the German army waited for the all-weather ROLAND II. To complicate the problem of standardization, the US decision to co-produce ROLAND II was accompanied by a "minimum" commitment only of interchangeability of the missiles themselves.

Differences in national requirements have influenced the entire course of development of the MRCA. The British originally wished a two-seat interdiction/strike aircraft, the Germans a single-seat close support plane, and the Italians a single-seat air-superiority fighter. After the single-seat version was abandoned, Germany reduced her requirement from 600 aircraft to 400 and Italy from 200 to 100. In the final production there are mission-oriented variants, and there are also strictly national differences in areas like communications equipment. It may be sufficient for military effectiveness that the MRCA and other pattern 3 systems are merely interoperable. Moreover, they have never been intended to be completely interchangeable.

From the standpoint of NATO as a whole, these developments seem to point to a limited number of weapon systems in one field rather than to a single system for all Allies. The efforts of pattern 3 have aided the growth of a European defense industry in which the major nations do collaborate and usually seek to avoid direct duplication of effort and destandardization. They have encouraged European military technology

at a time when rising costs threatened to make purely national projects impossible. Britain's commitment to the MRCA marked the final step in her movement away from almost complete aircraft self-sufficiency through the expensive effort to combine the indigenous Rolls Royce engine with the licensed American F-4 airframe to full participation in a completely European project. French collaboration with Britain, Germany and Italy on the JAGUAR the ALPHA JET and the series of guided missiles was a move away from a strictly autarkic weapons program and a prelude to the relatively active French role in the European Program Group. German involvement with each of the other major European Allies was a continuation of the FRG's traditional role as a promoter of NATO cooperation.

Nonetheless, the experience of the pattern 3 cases suggests inherent limitations on the prospects for NATO-wide standardization. The efforts of the past decade have been a reaction against the very effective standardization that flowed from earlier American dominance in technology. At the least the recent projects were initiated to further European technology and to avoid the need to accept American designs and pay American licensing fees. At the most they were intended to challenge US products in NATO and world markets. The MRCA was an obvious attempt to emulate French autonomy and avoid the need to purchase from abroad a follow-on to the F-104. The MILAN and HOT antitank missiles and the ROLAND air defense systems have competed directly for sales with the American DRAGON, TOW and CHAPARRAL. And even within European NATO there have been few multinational programs and no major projects that have included Britain, France and Germany together. The MRCA competes with French aircraft as well as with American; the HOT and ROLAND, with the British SWINGFIRE and RAPIER as well as with the above-noted US systems.

Once these systems have been developed and produced, there is an inevitable national predisposition to favor them and their potential successors. There may also be a general European apprehension that because of its size and unity, American industry will always be able to outdesign and outproduce Europe in most military fields. Finally, the

major European countries believe that military R&D and production know-how can make substantial contributions to civilian technology.

The existence of these factors casts doubt on the prescription of Thomas Callaghan and other Atlanticists that the development and "rationalization" of the European armaments industry should and can be followed by the establishment of a trans-Atlantic common arms market with all of its implications for specialization as well as standardization (Ref. 8). GRC's research suggests that it is more likely that various and sometimes shifting combinations of European allies will wish to continue two- or three-nation ventures even at the cost of some duplication within Europe and a considerable amount of duplication vis-a-vis the United States. In this event the hopes for improved effectiveness of NATO weapons rests primarily on promoting substantial interoperability and avoiding major proliferation of comparable systems. This means a level of achievement somewhere between the standardization on the American model of pattern 2 and the unsystematic and often fortuitous accomplishments of pattern 1.

PATTERN 4. COMPETITIVE COMMON SELECTION

The Quest for NATO Unity

The projects in pattern 3 have solidified the earlier transfer of American technology. They have also established European R&D that is competitive with the United States in many fields, and they have sustained a military-industrial production base that is narrower that that of the US but impressive in many of its achievements. Once pattern 2 had been outgrown by the Europeans, these accomplishments were essential if there was to be any possibility of widespread NATO standardization. However, the factors of potential sales and political prestige that trigger co-development agreements inevitably have diverted attention from maximization of military interoperability and of economies of R&D and production. Nevertheless, for a few key systems, NATO experience includes a pattern, pattern 4, in which standardization or interoperability was the dominant consideration in selection and licensed production was a critical device in facilitating selection among competitive developers or offerors. In

pattern 4, licensed production or co-production is undertaken to facilitate common selection and procurement among competitive systems.

NADGE: Major Success with a Non-controversial System

The NATO Air Defense Ground Environment (NADGE) system is a system of radars, computers and electronic data transmission systems that supplements air defense elements of nine continental European Allies (all except Portugal). By its very nature it requires central control and compatible equipment. In fact the establishment of NADGE in the mid-sixties did combine central direction of a single integrated system with the advantage of competition in design, development and planning of production allocation. Political disagreements meant that the 13 financing nations could agree neither on design nor on the companies to be included in the project. The governments therefore requested bidders to offer a design as well as a bid-price; they allowed each of three bidding consortia to structure itself and select the companies that each wished as subcontractors. However, they required that the contributions of each nation be balanced by the value of the contracts awarded its firms. As a result, each consortium had to consider long-term political and economic factors as well as the technical competence and productive efficiency of potential subcontractors (Refs. 4,5). One analyst has stated that this process ensured a "built-in guarantee to all participating countries of financial, industrial and military value" (Ref. 4, p. 21). From the NATO standpoint, the restrictive effects of this guarantee were minimized by assuring selection from among three competing solutions.

After the competition the winning consortium tried to maintain a balance between central direction and sensitivty to national pressures. As NADGECO, it dealt directly with participating governments and a Management Office established at the NATO level (NADGEMO). Establishing a rule that losing the original bid did not mean losing all chance of participation, it awarded subcontracts to many firms that had not been in the consortium at the time of the competition. Subsequently there were criticisms that individual national interests were ignored. This feeling may have been heightened by the fact that the consortium was headed by

an American firm, Hughes. However, any project of comparable economic and geographic scope would inevitably provoke disagreement.

The organization of NADGE suggests that the problems of co-production which had been resolved for several nations in pattern 2 can be solved for all allies and can even be extended to the area of co-development. NADGECO, the winning consortium, offered a permanent organization that could mediate among member companies and national governments, deal directly with a management office at NATO level, and integrate political and economic pressures with military goals. The fact that the consortium could allocate production to a "losing" subcontractor points to a broader possibility of competitive developers becoming associated in the final co-production process. There does remain some question as to whether such efforts would have been likely if the requirement for integration in the military system had been less obvious.

LEOPARD 2 and US XM-1 Tanks

One system for which the military desirability of standardization has long been as obvious as the lack of standardization is the tank - the principal NATO ground forces weapon system. With new pressures for standardization on both sides of the Atlantic, the US therefore offered in late 1974 to open its national tank development program, the XM-1, to consideration of an updated version of the proven German LEOPARD tank, which had emerged from the aborted US/FRG MBT-70 program. Although a direct competition for US selection was scheduled for September 1976 between the LEOPARD 2 and Chrysler and General Motors versions of the XM-1, various agreements and understandings between the two governments have led to efforts to harmonize separate tank programs and ensure their interoperability rather than to common selection or even a US selection of a German system. Efforts at subsystem standardization have focused on a common track, night vision devices, metric fasteners, diesel fuel, and the fire control system. Moreover, the US has agreed to modify its version for possible adoption of the German or British 120 mm gun, and the Germans have agreed to consider the Chrysler gas-turbine engine for its future LEOPARDs.

The tank standardization efforts illustrate the difficulties of co-development between major military powers on a central weapon system. Differences in tank doctrine and desired technology were greater than those over the MRCA and other jointly developed aircraft. The tank experience suggests that differences in military doctrine and traditions of national autonomy make it hard for even the best technicians to pool their expertise effectively in a common cause. It also indicates that each nation harbors legitimate doubts about sacrificing any of its own development and production capability and becoming more dependent on those of an ally.

However, these cautions should not obscure the importance of the recent German-American agreements. The two governments have acknowledged the failure of the MBT-70 ideal of co-development (see pattern 3) and have allowed for national variations and product improvement. By so doing they have increased the possibility of a more limited form of standardization. In terms of military efficiency, reasonable interoperability for the NATO main battle tank may be the equivalent of complete standardization of small arms and artillery ammunition and of the NADGE system.

If this is so, the US-FRG decisions are one of the most important steps yet taken toward realizable standardization. The German LEOPARD 1 has been adopted by Italy, Belgium, the Netherlands, Denmark and Norway and is as close to a universal European tank as now exists. Additionally, the FRG has initiated a collaborative program with the United Kingdom aimed at production in the 1980s. This recognizes the substantial tank design and production capability of Britain that so far has been represented in the German-American attempts at tank standardization only through the main gun. Moreover, France - with impressive tank design and production capabilities of its own - has been even more removed from the latest German-American efforts. Thus, the current efforts to harmonize the LEOPARD 2 - XM-1 development by standardization on critical components (probably involving licensed production) rather than total system design still await, but may have made possible, future involvement of Britain and France.

Comparison to F-16

The selection of the F-16 by Belgium, Denmark, the Netherlands, and Norway for their air forces bears some similarity to the NADGE case in that licensed production and a prior commitment to standardization were critical elements of the decision by these four countries. In this case, however, no losing competitor or element thereof received any share of the licensed production, and non-contending industries of the consumer countries received all the benefits of the licensed production. Licensed production in this case was an element of competitive sales to offset expenditures of purchasers more than a means of supporting or preserving, for the benefit of future competitions, the developmental capabilities of losing developers with advanced productive capabilities.

The situation in which two versions of the US XM-1 tank and the German LEOPARD 2 were developed is somewhere between the NADGE and the F-16 cases. Interoperability rather than standardization on a single tank for the two countries is likely to be the outcome of negotiations and compromises between the tank prototypes. This could be achieved by trans-Atlantic licensed production, on a two-way basis, among critical components of the tank systems.

APPRAISAL

Each of the four patterns of NATO licensed production can make a contribution to standardization and interoperability. Each also has certain disadvantages and costs.

Pattern 1 encourages the most flexible use of the independently developed resources of the Alliance. It permits any nation to fill gaps in its inventory, although with unpredictable and sometimes untoward results for the cause of standardization.

Pattern 2 allowed the European allies to strengthen their R&D and productive capacities and to equip their forces with sophisticated American aircraft and missile systems. However, this pattern is of limited value at the present stage of European technology and political self-confidence. Also it may be perceived as merely a ploy for US influence and sales.

Pattern 3 has permitted groups of European nations to develop their defense industries and to establish clusters of standardized weapon systems within the Alliance. This approach clearly strengthens NATO's overall military capability, but it also seems unlikely to transcend bi- or tri-national bases and thus is likely to perpetuate competition for European and third world sales.

Pattern 4 offers more hope of transcending the competitive product schema and of using technology cooperatively as well as competitively to design the most interoperable systems. The cases of NADGE and the MBT offer two very different ways to achieve interoperable systems. However, they also indicate the impediments to full standardization in the Alliance whose 15 members are each sovereign and where defense procurement has political and social/economic as well as military dimensions. Pattern 4, to the extent that it uses licensed production to facilitate common selection among countries with the highest development and productive capabilities and not just as an offset for purchasers who do not participate in competitive development, probably holds the greatest potential for NATO standardization in the future.

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Chapter 4
EUROPEAN INSTITUTIONS AND POLICY TRENDS

GENERAL

This chapter analyzes recent European institutional and policy developments that affect licensing as a tool of standardization. The scope of the study did not make possible the direct access to governmental officials and internal government documents that underlies the analysis of US trends in Chapter 2. Hence, this analysis draws heavily from quasi-governmental and non-governmental sources and, by inference, from the patterns of licensed production discussed in Chapter 3 and from the European industrial perspective presented in Chapter 5 and in Volume III.

The first section below is an overview of the principal, distinctive European forums in which European perspectives on standardization have been exchanged and developed in the last five to ten years. The second section analyzes the policy stances of the principal European states. The third section discusses two dominant themes that characterize current European policy and institutional trends, namely, the "two-way street" concept and the concept of "rationalization" of European military development and production. The final section assesses three possible US policy responses in the areas of licensing, sales, co-development, and co-production.

EUROPEAN FORUMS DEALING WITH STANDARDIZATION

Background

As in the US, defense officials and military leaders in Europe have long advocated standardization of weapons and equipment among Allied

forces as the principal means of ensuring the interoperability and thus the effectiveness of national military forces. Particularly with the "layer cake" type of deployment of national forces by corps sectors running perpendicular to the eastern border in West Germany, interoperability through standardization seems virtually a military necessity for the strategy of forward defense and flexibility in response to any type of Pact attack (Ref. 1).

However, for reasons suggested in Chapter 3 concerning the development of Europe's technological-industrial base in comparison to that of the US, and while the equipping and supporting of military forces remains a national responsibility of sovereign states, destandardization has resulted from Europe's increasing economic strength and ability to design, develop and produce sophisticated weapons and equipment. Destandardization in this context means especially a veering away from standardization on US designed and developed weapons and equipment. As European technology and industry matured - to a large extent under the impact of licensed production in Europe of US developed systems - European technology and industry became competitive with US technology and industry. At the same time, beginning in about 1963, the US sought to increase sales to Europe from US production in order to help offset balance of payments (BoP) problems deriving from the large US deployment in Europe.

By the end of the 1960's Europe as well as the US began to realize with greater urgency that this type of destandardization - with both the US and Europe competitively seeking sales to allies of domestic developments and, in turn, buying from domestic sources whenever possible - placed an economic as well as a military burden on the alliance as a whole. Such a burden has been well documented by Thomas Callaghan and others (Ref. 2).

NATO-Wide Forums

There have been many attempts to find policy and institutional devices to promote standardization. The principal NATO devices include: the Military Agency for Standardization (MAS) of the Military Committee and its 600 Standardization Agreements; the Conference of National Armaments

Directors (CNAD) of the North Atlantic Council (NAC) and its 140 committees; the NATO Industrial Advisory Group (NIAG); and the many bilateral and multilateral collaborative, co-production, and co-procurement arrangements that have sprung up within the last fifteen years. Despite such attempts some observers found that by 1975 NATO had moved in the direction of less standardization (Ref. 3).

For years the basic approach to standardization in NATO was to seek common agreement on requirements and standards - through such devices as the NATO Basic Military Requirements (NBMRs) identified by the Military Authorities and the Standardization Agreements (STANAGs) formulated in the MAS - and vest implementation of these entirely in independent national decision-making and follow-on programs. Agreement on requirements and standards in the international military arena of the alliance was not difficult to accomplish - that was the function of the agreeing bodies - but specifying the means to implement these agreements was not their function and was not accomplished. Rather than leading to implementation, formal agreement almost became a substitute for action. Nations procured their weapons and equipment according to national criteria of need and availability with little or no conscious adherence to formal agreements.

The NBMR approach had become cumbersome and rigid as well as ineffective by the mid 1960s. Since then, the real burden of achieving weapons standardization and interoperability has shifted to the civil authorities and institutions within NATO. This shift recognized that achieving cooperation in development and common selection and procurement is fundamentally a political and economic problem more than a military problem. A fresh start was begun in May 1966 when the North Atlantic Council (NAC) approved the report of an exploratory group set up to study the problem of standardization and to propose new solutions. The principal institutional device to emerge from the ensuing reorganization was the Conference of National Armaments Directors (CNAD), which consolidated and replaced the earlier Defense Production Committee, the Armaments Committee, and the Committee of Defense Research Directors. Besides

focussing standardization efforts in the civil structure of NATO and consolidating its committees, this shift also recognized that the implied mandatory approach of the NBMRs could not work and that what was required was a flexible, clearly voluntary system of exchanging information on national R&D and procurement programs and encouraging cooperation among any two or more NATO members in meeting their national requirements. A unique device of non-official civilians was also created in 1968 to facilitate information exchange and voluntary cooperation on a broader basis encompassing defense industries in the member countries. This is the NATO Industrial Advisory Group (NIAG). Besides providing a forum for exchange of information and encouraging industrial cooperation, the NIAG has been used to perform prefeasibility studies in various critical areas of armaments.

In 1971 the work of the CNAD and its subgroups was given sharper focus and redirected to concentrate on the most pressing needs for the Alliance as a whole. Budgetary and economic problems in all NATO countries gave a new urgency to achieving more efficient uses of resources in the high priority, high cost areas of new weapons requirements through standardization. Accordingly, the CNAD began to work much more closely with the Military Authorities in identifying the most critical areas for interoperability. In addition, by the beginning of 1976, NATO had created nine special agencies (three of which no longer exist because they have completed their work) to manage integrated programs in weapons and logistics standardization. There were also twenty Steering Committees for approved NATO co-production projects. At the policy level, two overlapping subforums of the CNAD have become increasingly important. These are the EURONAD, consisting of the European national armaments directors, and the Four Power CNAD, consisting of the national armaments directors of the US, the UK, the FRG, and France.

After the US initiatives in mid 1975 for NATO to develop new and stronger commitments, policies, and procedures for achieving standardization, the NAC in Ministerial session in December 1975 created an Ad Hoc Committee on Equipment Interoperability to seek to develop practical

steps in this priority area and implicitly tabled immediate new action on standardization, pending further development of intra-European and US interests and trends.

Eurogroup

With pressures on European defense budgets and disillusionment in both Europe and America about the political and economic cost to the US of its involvement in the Vietnam War, the European members of NATO (except France, Portugal, and Iceland) had begun meeting in Ministerial sessions in 1968 to seek stronger and closer European cooperation (Ref. 4). The initiative for this activity was the UK's when Dennis Healey was Secretary of State for Defence. Responding to the challenges of AD-70 (the NATO study of Allied Defense in the 1970s) and the mounting US public and congressional pressure to decrease its military involvement overseas, the resulting "European Group" (Eurogroup) embarked on its European Defence Improvement Program (EDIP) in late 1970, adding about $1 billion in funds to the NATO infrastructure program over a five-year period and stimulating some increased national force contributions. Since then Eurogroup has spawned seven additional programs or groups dedicated to European cooperation and "harmonization," if not standardization in the following areas:

- tactical communication - EUROCOM
- logistic support - EUROLOG
- tactical concepts - EUROLONGTERM
- military medical services - EUROMED
- a sub-group of the CNAD - EURONAD
- training - EUROTRAINING
- force structure information - EUROSTRUCTURE

With respect to their relation to the US in NATO, Eurogroup can be interpreted in two ways: first, as an effort to show the US Congress and the public that Europeans are willing to carry a larger share of the defense burden than before and thus elicit support for a sustained, strong US presence in Europe; and, second, as a hedge against a decreasing US contribution and role. A third interpretation

is also possible - namely, that Eurogroup would enable the European NATO members "to speak with one voice" in their dealings with their larger American partner. As European collaborative weapons development programs - mostly on a binational or trinational basis - began to show that they could compete technologically with US developed systems, this third interpretation began to take on increased relevance on both sides of the Atlantic. The first two interpretations were ambiguous enough, and the third interpretation compounded an ambivalence toward Eurogroup that existed within the US Executive Branch agencies and the Congress.

Following the US initiatives in 1974 by both the Secretary of Defense and the Congress to commit the US to NATO standardization, the Eurogroup took up the theme with greater earnest as a trans-Atlantic issue as well as an intra-European issue. By no means abandoning the efforts to improve European governmental cooperation and associated programs of multinational teaming in weapons development and production, the Eurogroup became increasingly, in late 1974 and early 1975, a voice of Europe in NATO standardization. With the publication of several revised and enlarged or summarized versions of the "Callaghan Report" (Ref. 2, 5, 6), which were given wide circulation in Europe, NATO standardization as a primary theme of Eurogroup became virtually synomous with the "two-way street."

Many hopes (or illusions) were fostered that NATO was about to enter a new era in which European NATO would be increasingly integrated in defense and the US would drop its "Buy American" restrictions and begin to buy as much of its defense material in Europe as Europe bought in the US. The US Army's selection of the German-French ROLAND II to satisfy its requirement for a short range air defense missile was seen as an earnest of the new era.

On the European side, four of the smaller countries of Europe, who were predominantly consumers of complex technological systems that require a large technological and industrial base rather than developers or producers, formed an ad hoc committee on standardization and agreed to procure the same plane to replace their F-104Gs. While this provided

recognition that the smaller NATO states had an important role to play in achieving standardization on a scale commensurate with their requirements, it put the developer/producer states in even more direct competition, with larger stakes - "the arms deal of the century." Competitive offers of offsetting arrangements - including especially licensed production of a portion of the total world-wide sales - became, at least to European competitors, a major part of the final selection of the US F-16. Little matter that the F-16 could be proven to be the superior plane or that its selection by Norway, Denmark, the Netherlands, and Belgium could be heralded as a large step toward standardization of their air forces with the US Air Force, the aircraft developing and producing industries and countries of Europe could interpret this as effective US sales as much as committed US policy on standardization.

President Ford's speech at the NATO Summit in May 1975 and its follow-up in August with circulation in NATO of a draft US policy statement on standardization guidelines and on the creation of a NATO Steering Committee on Standardization gave tolerant European interpreters a basis for accepting the F-16 as a case of standardization and pressing on with new European policy initiatives through Eurogroup. At the Eurogroup Ministers meeting of 5 November 1975, provisional plans were laid for the creation of a staff or secretariat that could begin to collect and collate information on European R&D and procurement programs with a view to facilitating further European rationalization as the US policy initiative had urged (Ref. 7). Following this meeting, a select group of senior staff personnel from the ministries of several Eurogroup countries travelled to the US to meet with interested representatives of US industries, government, and research institutions. The two-way street was the principal message. Eurogroup also sent an unprecedented delegation of European parliamentarians to testify before the US Senate in hearings held on NATO standardization on 31 March 1976 (Ref. 8). Again, the message was the two-way street.

Western European Union

Because of the non-participation of France in Eurogroup, its efforts were necessarily truncated. The Western European Union (WEU),

a bit moribund as an institution of European integration in most respects, did provide an additional forum and one in which the interests of France could be represented. Consisting of the original signatories of the Brussels Treaty of 1948 (Britain, France, and the BENELUX countries) plus Italy and the FRG (who were added in 1954), the WEU has been a kind of "structure in waiting" for a revived or newly integrated European defense community - outside the formal structure of NATO with its strong US presence, but compatible with that structure.

Beginning in 1970, the WEU took new initiatives toward rationalization and standardization, especially in European NATO. In November 1971, the Committee on Defence Questions of the Assembly of the WEU recommended on a formal basis that five studies be undertaken on a priority basis to find ways of more rationally using the collective resources of NATO to meet urgent defense needs (Ref. 1, p. 3). Three of these studies were to deal directly with matters of rationalization, standardization, and interoperability. They were: (a) "a rational distribution of defense tasks between countries," (b) "a concerted long-term programme for standardized armaments procurement," and (c) "collective logistical support." Of the other two - namely, "maldeployment of forces on the Central Front" and "a comparative study of the structure of national defense organizations" - the former concluded that the most urgent need of the Alliance was increased standardization in weapons procurement and recommended that NATO undertake a major study of this problem comparable to the study, Allied Defense for the 70s (AD-70).

Committed by treaty (the Paris Protocols of 1954) to standardization, the WEU has continued its efforts by sponsoring a major symposium on the European civil and military aircraft industry in February 1976 and by planning a similar symposium on military standardization and its relation to European industry for February 1977.

European Program Group

But the WEU - with its particular history and without NATO's flanks represented - could not represent collective West European interests vis a vis other NATO members including the US even as well as Eurogroup could without France.

By late 1975, along with its support of a NAC Ad Hoc Committee on Equipment Interoperability in place of the US recommended creation of a Steering Committee on Standardization, France had signalled its willingness to participate in some broader European forum than WEU that was also free of a direct tie to NATO with its military structure and US predominance Both other Europeans and the US cautiously received and even welcomed this two-fold French move. In December 1975, the NAC created the Ad Hoc Committee on Equipment Standardization and the Eurogroup Ministers formally blessed creation of the new European forum, originally called the European Independent Program Group (EIPG) and later renamed simply the European Program Group (EPG) (Ref. 9).

Several interpretations of the significance of the EPG and France's role in its creation are possible. One interpretation is that the French merely intended to and at least temporarily have succeeded in slowing a momentum toward standardization policies (and slogans) that would leave France behind. At the other extreme is the interpretation that France had finally seen some of the bitter fruit of its own assertive independence and now is seeking genuinely (if self-interestedly) to participate actively in Europe-wide programs of defense cooperation so long as it is not pressured or forced to reverse its chosen path of independence of the NATO military structure. Unable fully to disbelieve either interpretation, most non-French observers have adopted a wait and see attitude and have applauded the energy with which the French have contributed to the discussions on interoperability. Moreover, there is some basis to welcome the pause for reflection that the French initiative gave to other NATO members and their initiatives that had gained perhaps a public momentum that could lead to disillusionment if not followed rapidly by new evidence of a new attitude on both sides of the Atlantic.

One variant interpretation by a French industrialist, discussed in Volume III, is that the French initiative was not anti-American nearly so much as a corrective to the imbalances in Eurogroup that tended (as in the UN) to make the larger, technologically and industrially competitive states a political equal with any state, however small or dependent. Such

a view cannot be dismissed as merely a bitter reaction to the F-16 selection over the MIRAGE F1, although it is clearly influenced by that selection.

For licensing policy options, the link between the F-16 and the creation of EPG and the pressure to focus on interoperability cannot be ignored. The F-16 selection involved the use of licensed production to facilitate a degree of standardization - but a standardization that is limited to one developer/producer state and several small states with only limited development/production capabilities in the type of system involved. The major NATO countries with capabilities to develop and produce high-technology, jet fighter aircraft were left out of the standardization. Perhaps on this basis, full standardization cannot be achieved or setbacks and attendant bitterness to losers avoided. Alternatives might have been to ensure only that the aircraft selected would be interoperable by concentrating on degrees of standardization at the critical component level. This is the way the XM-1/LEOPARD 2 competition appears to be leading for the US selection of a new tank. Licensed production of critical components - such as armaments and engines - appears to be simpler to negotiate on the basis of established industrial capabilities and, thus, to encourage stable development of such capabilities.

NATIONAL POLICIES

Whatever emerges from the EPG, or from Eurogroup or the WEU, will depend critically on how the views of the three dominant industrial countries of Western Europe are reconciled among themselves and in relation to the smaller countries with considerably less R&D and production capacity for the range of modern weapons their forces require.

France

France is critical of standardization on the basis of US equipment and has been the most vocal advocate of European military autonomy. French spokesmen have developed a coherent, if at times strained, argument that major efforts at standardization are both impossible and undesirable for the diverse North Atlantic Alliance. (See Volume III, part VI-C). The independent course France has pursued in strategic

weapons has been followed by strictly national development and production of most tactical aircraft and tanks.

However, the cost of the strategic arms program and of the MIRAGE series of aircraft apparently has led France to see the financial benefits of collaboration on some conventional weapons. The French have participated in several co-development and co-production projects that contribute to a degree of NATO standardization. They have joined with the UK on the JAGUAR aircraft, the LYNX, PUMA and GAZELLE helicopters, and the MARTEL air-to-surface missile. France has collaborated with Germany on the ALPHA JET and the HOT, MILAN, ROLAND and KORMORAN missiles. There has been cooperation with Italy on the OTOMAT antiship missile. Rising costs will probably lead to further joint projects. Although France would prefer to produce its own weapons in all categories, its prime focus is on the preservation of an autonomous nuclear capability. To achieve this goal, it is probably willing to pool resources on ground, naval and tactical air systems with other European Allies and perhaps with the US.

Germany

Germany always has been the strongest proponent among major NATO nations of licensing to achieve standardization. Germany was the one country to remain in both of the early co-production projects, the G-91 and the ATLANTIC. It arranged the historically important F-104G program and played a leading role in HAWK and SIDEWINDER. It has sought cooperation with France, the US and the UK on a main battle tank and recently joined the US in a statement of intent to harmonize key components of the LEOPARD 2 and the XM-1. Germany also has been one of the two major partners on the tri-national MRCA and has collaborated with France on a series of tactical missiles.

There are several reasons for this consistently pro-NATO position. Germany's role in World War II made the Federal Republic anxious to prove that it was a loyal member of the democratic Western Alliance and a "good European." The relatively late development of Germany's post-war arms industry meant that for a long time it was dependent on the

R&D and production capacity of other European nations and the US. Even after recovery, the national decision to limit the size of the defense industry has made it impossible for Germany to finance long production runs through foreign sales as Britain and France have done.

In military terms, Germany's forward geographical position makes the nation very sensitive to the need for Alliance cohesion and for interoperability among weapons of front-line troops. This focus has been strengthened by an almost land-locked location and by the lack of colonies which for so long diverted Britain and France from full concentration on NATO. Finally, the relative stability of Germany during the European economic difficulties of the last few years has made it appear as the strongest European member of the Alliance. This has increased the earlier tendency to take a NATO-wide perspective and to search for the most economical means of maintaining a European defense capability.

These factors make Germany the most important nation in the relationship between European NATO and the Alliance as a whole. In the terms of the licensing categories of Chapter 3, the Federal Republic has played a central role in the European resurgence of the pattern of intra-European co-development as well as the pattern of trans-Atlantic efforts at common selection (NADGE, MBT). US policy-makers considering the most practical future mix of these patterns will have to rely heavily on German judgments. To understand the implications of this position, it is only necessary to consider the situation of NATO if it were Germany rather than France whose commitment to the Alliance's military efforts was at times unclear.

Britain

The United Kingdom is the European latecomer to standardization through licensing and co-production. Until the early 1960s the UK considered itself the smallest of the three great powers rather than the largest of the medium-size states. It therefore tried to compete with the US and USSR in most major military fields and participated in only BULLPUP among the licensing projects based on US technology (the second

pattern in Chapter 3). When the UK decided to license the F-4 PHANTOM in the mid-60s, it retained a Rolls Royce engine even at a large increase in total cost of the aircraft.

This position has gradually changed as the result of increasing defense costs and the contraction of world-wide commitments. Britain has participated in several European co-production projects and may be prepared to enter into even fuller cooperation. Collaboration with France on the Concorde civil aircraft led to co-development and co-production of the JAGUAR. Britain has been a leading member of the MRCA consortium and therefore has been able to place a Rolls Royce engine in a strictly European aircraft. Although the largest amount of total UK aircraft sales are still to the United States, British spokesmen have spoken of the need for Europe to maintain a "high technology" of its own. Such statements indicate that a European orientation has now joined, even if it has not replaced, the earlier notion of a special relation with the US.

Outside the field of aircraft, the UK has joined Germany in co-development and co-production of the FH-70 and SP-70 howitzers. Most important, it is collaborating with the Germans on a tank development program aimed at production in the 1980s (MBT-80). Britain did not participate in the series of German-French-American efforts at tank standardization during the past two decades. If the UK and Germany could reach agreement on a future main battle tank that could be produced in both nations, this would contribute substantially to reducing the current proliferation within the Alliance.

Other Nations

The smaller nations of Western Europe play a more fluid, if not ambivalent role, with respect to intra-European and trans-Atlantic aspects of licensed production and standardization of weapons and equipment. With inherently less R&D and other resources to invest in a wide spectrum of armaments industries, they are more readily prepared to accept other country designs for licensed production to assist domestic employment and to cope with balance of payments problems that would result from

extensive direct purchase. Italy's co-production of the US M113 armored personnel carrier, its licensed production of the German LEOPARD 1 tank, and its scheduled co-production of the British-German FH-70 and SP-70 howitzers are examples of this readiness to accept licensed production. The Belgian, Danish, Dutch, and Norwegian selection of the US F-16 with licensed co-production offsetting arrangements is a further illustration of the importance of such arrangements to the smaller European countries. The potential and present ambivalence in such arrangements concern their long-term effect on intra-European technological-industrial development and its relation to a trans-Atlantic two-way street.

CURRENT ISSUES

"Two-way Street"

The growth of the European arms industry has led to complaints about the balance of US-European military trade. Britain and France are particularly sensitive on this point, since they rely on foreign sales to finance long production runs and maintain and improve their R&D capabilities. The Europeans assert that the US market remains substantially closed to licensing as well as to direct sales. They state that with the rare exception of a HARRIER or ROLAND, the US develops and produces all its own major military systems. An extreme charge sometimes made by French spokesmen is that the American commitment to standardization extends only so far as sales of US weapons. The phrase "two-way street" has been used with increasing frequency to symbolize the European desire for mutual sales and co-production.

The European capability to produce most types of major military systems means that the Allies no longer depend heavily on purchases or licensed production from the US. The change is illustrated by the fact that the initial list of co-producers and potential purchasers for the F-16 included only four smaller nations; it omitted Germany and Italy, which had participated in the F-104 project.

Rationalization

Some proponents of standardization have called for the "rationalization" of the European armaments industry as the prelude to the

establishment of a trans-Atlantic arms market (Ref. 2). Such rationalization presumably could range all the way from increased cooperation of a few firms within or across national boundaries to the restructuring of the European market along relatively free American-style lines. In this type of market, economic efficiency would take priority over national concerns for R&D and employment.

Substantial rationalization has taken place over the past decade. There have been several major consolidations of the aircraft industries in Britain and France, and more seem likely in the near future. Numerous projects in aircraft and tactical missiles have led to close cooperation between large corporations in Britain, France, Germany and Italy. In certain fields of military production, international consortia are now more important than national firms. The leading example is Panavia, which has developed and is producing the MRCA. Possible further development of this form of organization is discussed in Volume III.

However, this cooperation is unlikely to transcend national boundaries completely. Past experience with licensed production has shown that each nation demands careful calculation of cost-sharing and work-sharing formulas and is constantly concerned with its own balance of payments. Firms or entire industries that are weak by Europe-wide standards may seem of vital economic, military, or political importance to the individual country concerned. Any assessment of the nature of future rationalization must balance these factors against the value of multinational economic efficiency.

ALTERNATIVE US RESPONSES

In view of current European institutional and policy trends, three broad US responses seem to present themselves.

Option 1. Withdraw from major efforts at licensing or sales except for expensive and highly specialized systems like AWACS and some types of missiles. This option would have the advantage of encouraging further development of European industry and of ensuring it some of the benefits of long production runs. However, it would divide the total economic and technological resources of the Alliance and deny each side

the benefits of advances by the other. Option 1 could also encourage even greater cartelization within Europe and lessen the incentives for efficiency and innovation.

Option 2. A major licensing and sales effort, following the F-16 example and aimed at the smaller consuming nations. This policy would give the maximum choice in procurement to those countries without major development capabilities of their own. Such an effort would also force the European producers (Britain, France, and Germany) to make their military equipment competitive with that of a major rival. The drawback to such a policy is that it would tend to split NATO into producer and consumer factions and to weaken the cohesion of the Alliance even more than would US withdrawal under option 1. In particular, this option would threaten to reinforce French suspicions of the US at a time of gradual rapprochement and to convince the otherwise strongly pro-NATO and pro-US Germans that the Gaullist position may be correct after all.

Option 3. A pragmatic combination of US co-development as well as co-production with European allies and of US participation in selected NATO-wide common projects. Under this option, the R&D capabilities of all the Allies could be used to determine the best system for production. Co-production would ensure stable employment as well as maintenance of the R&D level on both sides of the Atlantic. Under this option, the current high level of European technology, the increasing rationalization of European industry and the European desire for a two-way street would work to the benefit, rather than the detriment, of the Alliance.

Current European economic strength and political assertiveness probably means that co-development, combined with co-production, is the most likely means for US industry to retain some place in the European market.

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Chapter 5

THE PROSPECTS FOR ALLIANCE STANDARDIZATION: A EUROPEAN INDUSTRIAL PERSPECTIVE

GENERAL

This chapter provides a summary of a survey of the European defense industrial environment within which new US initiatives regarding NATO standardization will have to function. The survey, presented in complete form in Volume III, is concerned with the European defense industrial scene as it relates to US policy and actions in the furtherance of NATO standardization.

The objective is to survey all of the principal European defense industrial sectors—aircraft, missiles, shipbuilding, and tanks and guns; to produce country and corporate profiles in each industrial sector; and to draw conclusions about the probable European industrial response to different types of US initiatives, especially in the area of direct licensing between Europe and the United States.

One of the key factors concerning the European defense industries is their complexity. This complexity is evident in the duplication within national industries and the new trend toward multinational collaboration. Other primary factors affecting these industries are defense budgetary pressures, concerns over full employment, competition for export markets, and a decline of civil markets. These factors affect the problem of matching US proposals to European industrial requirements and capabilities.

The following sections contain the findings and recommendations of the survey. They are ordered by industry, beginning with a discussion of the aircraft industry, including the international collaborative trends and analyses of the national industries. This is followed by similar

discussions for the aircraft engine industry; the tactical missile industry; the naval shipbuilding industry; and armored vehicle and self-propelled gun industry. The chapter concludes with a discussion of some current industrial issues.

AIRCRAFT INDUSTRY

Collaborations and Companies

Virtually all of the major development and production programs, both civil and military, in the European aircraft industry are now collaborative in nature. These collaborations are based on strict cost-sharing and work-sharing formulas, established in advance among the national partners. Although such arrangements are cumbersome, they provide the most satisfactory available solution to the sharing of economic burdens and benefits in the aerospace industries. Any new American overture to achieve greater standardization in the aircraft or missile field should take account of this evolution, which has already begun to improve the standardization of air forces and ground forces in the central European theater.

Experience of the last fifteen years has led to the evolution of a new industrial form in the aircraft industry - an international management company, responsible to ad hoc inter-governmental bodies for the coordination and supervision of work performed by designated national industries in the consortium. The most advanced example to date is Panavia in Munich, responsible to a NATO body for managing the development and production of a possible 800 or more variable-geometry fighters for three major European NATO air forces. Panavia is especially important because of its growing vested interest (supported to varying degrees by the participating governments) in identifying further collaborative military aircraft projects with additional partners such as the United States or France.

In the military aircraft field, four major companies have developed the highest degree of expertise in conducting and participating in collaborative programs. In order of experience, these are: British Aircraft Corporation (BAC), Messerschmitt-Bölkow-Blohm (MBB), Dassault-Breguet, and Aerospatiale (or SNIAS).

In general, there have been important bilateral collaborations for military aircraft but relatively few multilateral programs to date, especially programs that would combine British, French, and German industries in a single project. One impediment to date has been the issue of design leadership, especially with regard to aircraft engines, which represent the starting point of any military or civil aircraft program.

An issue of great importance, but still nebulous and of extreme political sensitivity, is potential collaboration among these three governments, in one form or another, on a comparatively inexpensive fighter aircraft to fulfill either an interceptor or air-to-air combat role in the late 1980s and 1990s. This question has been brought to the surface by its inclusion in a list of four topics to be considered by subcommittees of the European Program Group (EPG). Obviously, this issue is also of interest to the United States. Such an aircraft can be described as an F-104G replacement, a replacement to the current generation of MIRAGE aircraft, or an interceptor for national air defense and policing of national airspace. Typical candidates might be airframes such as the F-16 or MIRAGE 2000 or, if a twin-engine aircraft were preferred, an F-18 or Super MIRAGE. Potential engines might be the RB-199, M-53, or a US engine. Panavia and its equivalent engine management organization, Turbo-Union, could provide a useful focal point for trans-Atlantic examination of collaborative opportunities.

British Aircraft Industry

The British aircraft industry, with about 200,000 workers, is the largest of all the European national aircraft industries, representing about half the total European aerospace workforce. It is the only European industry with fully developed capabilities in aircraft, state-of-the-art turbofan engines, and aircraft electronics. On the other hand, it has been severely criticized by other national industries for its low rate of productivity in terms of output per worker, a factor that has created difficulties in the negotiation of collaborative programs.

Although published analyses of the EC Commission on this problem have somewhat exaggerated the differential between Britain and other countries, there is no doubt that British aerospace worker productivity is lower than in Germany or France, and much lower than in the United States. These differentials are described in Volume III. Differences in productivity between Europe and the United States are due primarily to differences of industrial scale.

In Britain, as in other European countries, comparatively low quantitative demand for military and civil aircraft has suppressed major new investment in plant and equipment and has led to trans-Atlantic disparities in manufacturing technology and, as a result, product technology. This situation is a source of friction in licensing from Europe to the United States and a source of cost (and cost accounting) conflicts in licensing from the United States to Europe. In Britain, as in France and Germany, the most severe difficulty currently being encountered by the aircraft industry is under-utilization of capacity on troubled civil aircraft production lines. The company most affected in Britain is BAC, where about half of the factory workers are assigned to Concorde, Airbus, and other civil programs. Although the military lines assigned to JAGUAR and MRCA are well capable of supporting the workers currently employed on those programs, BAC faces severe difficulties in utilizing the civil share of its workforce.

This problem is echoed at each of the major European airframe firms, such as Aerospatiale and MBB. A rough estimate, based on the discussions that follow, is that about 50,000 workers in the three major aircraft-producing countries are imminently threatened by such problems as the slow-down or cessation of Concorde production and the stretch-out of orders for Airbus. US initiatives for standardization in the field of military support aircraft that take this problem into account will, of course, be especially welcome. However, the main support aircraft initiative that has recently been mounted by the United States - that is, the

Boeing E-3A AWACS - offers only a modest amount of work-sharing and also ignores recent trends in European industrial collaborative practice.

The imminent nationalization of the British aerospace industry will undoubtedly lead to a major review of both civil and military collaborative prospects for BAC, Hawker Siddeley, and Rolls-Royce. It also seems likely that this process of nationalization will gradually lead to integration of different company divisions along substantive lines, such as the integration of the tactical missile groups in BAC and Hawker Siddeley. If these integrations are successful, then British military aircraft and tactical missile industry groupings should, within a few years, be larger and more effective than they are now. These new groupings will, however, remain committed to international consortia rather than to purely national programs.

BAC, whose military aircraft division is the British participant in both the JAGUAR and MRCA programs, can be regarded as the chief architect and planner of European military aircraft collaboration. The BAC management has accumulated more experience than any other European group in the management of large-scale international military projects.

The national aerospace industries in both Britain and France have a vital foreign-earnings role. The British industry has been highly successful on the export market in recent years, setting a succession of annual records. At the end of 1975, over 70% of BAC's total backlog of nearly $2 billion was for export, and Hawker Siddeley's export share may have been as high. Due to the high level of exports, the British aircraft companies have performed well financially in the last few years. In an eleven-year period from 1963 through 1974, the British aerospace industry has exported slightly over 50% of its entire turnover. Nearly half of this backlog represented orders from the United States, France, and Germany as part of license or collaborative programs. This is a significant point for purposes of comparison with France, where a much higher proportion of exports is to the third world. For the moment, British industry is not as sensitive as French to the hazard of third-country export controls resulting from US licenses, but this situation may change rapidly as US manufacturers preempt third world markets.

In Britain and France, and to lesser extent in Germany, the concern over the absence of civil programs, or of military derivatives of civil transport aircraft, is of paramount importance. Military and naval support aircraft projects capable of filling the current order gap could be of vital importance in gaining a higher degree of European aerospace cooperation. For Europe, as many observers have noted, employment is the new measure of industrial achievement.

French Aircraft Industry

The French aircraft industry, employing about 100,000 workers, has been more productive than the British industry in terms of output per worker and currently exports about 60% of total industry production, a vast majority of which is military. Although the engine and avionics industries are not as highly developed in France as in Britain, the French airframe industry has concentrated its resources very effectively in a relatively limited number of programs. Its major difficulty is in establishing a viable role in commercial aircraft development and manufacture. Here, the French government has sought to establish bilateral relationships with the United States.

The two principal manufacturers are Aerospatiale, a nationalized company with about 40,000 workers; and the smaller Dassault-Breguet, a private company with about 15,000 employees. In spite of the deep admiration accorded in the United States to Dassault-Breguet as a developer and manufacturer of supersonic fighter aircraft, it seems possible that Aerospatiale is the most appropriate future industrial partner for the US in licensing and other collaborative ventures. Aerospatiale's divisions for helicopters, tactical missiles, and ballistic missiles all appear to be operating profitably, but severe difficulties in the commerical aircraft division have kept the company in a state of turmoil. Dassault-Breguet, on the other hand, by concentrating its resources on incremental improvements in a few narrow but highly successful lines, continues to expand its MIRAGE order backlog while maintaining participation in two important collaborative programs - JAGUAR and ALPHA JET. Nevertheless, the firm has

definite limitations of capacity, as well as management and technical depth, to undertake any major licensing or co-development outside its immediate areas of specialization.

Superficially, one exception to this judgment would be the possibility of trans-Atlantic or intra-European licensing or collaboration based on the MIRAGE 2000 single-engine fighter, which is now scheduled for its first prototype flight in 1977. In fact, however, Aerospatiale will perform at least half the production of this aircraft.* The concept involves a relatively light-weight advanced interceptor with a ratio of total thrust to takeoff gross weight of about unity. The technology of the aircraft calls for the use of carbon fiber in selected structure parts and fly-by-wire control systems. The aircraft will use the SNECMA M-53 military turbofan, which is of considerable economic importance to French industry.

In France, as in Britain and Germany, workforce stability is a critical issue. It is an issue that works two ways - both in terms of the political hazards (and in some cases illegality) of workforce reductions, and in a corresponding inability to expand the workforce significantly. Furthermore, it is more difficult in the European countries to shift workforce from one location to another, even in the same company, than it would be in the United States. For these reasons, there are strict limits on European ability to undertake any significant expansion to already well-occupied fighter aircraft production lines.

German Aircraft Industry

In Britain and France, the aerospace firms are the largest of the defense industries and the most important in terms of both employment and exports. In Germany, the Federal Government has made a consistent effort to control growth of military production in general and the aircraft industry in particular. As a result, although the aerospace industry numbers about 50,000 workers, its importance as an employer and exporter is not comparable to that of the French or British industries. A little over half the German aircraft industry workforce is employed in

*Some French industry observers argue forcefully, however, that Dassault-Breguet will retain the dominant French airframe manufacturing role, and that Aerospatiale will be forced to subcontract most of its airframe production to Dassault.

the three major airframe companies, MBB, Dornier, and VFW Fokker. In addition, there is a relatively small but important engine industry employing about 7,000 workers. Virtually all German aerospace activity is collaborative in nature, and Bonn has firmly established a policy of reliance on collaboration with the European allies or the United States in major programs.

Although Bonn has been generally amenable to a licensee role, especially with the United States, it has also sought to retain a subsistence level of R&D capability so that its own industry would be able to exercise independent critical judgments in collaborative programs, especially those with Britain or France. For US aircraft standardization initiatives with Germany, MBB is the logical partner. MBB, with a workforce of about 20,000, is the German partner in the Panavia consortium and also in the Euromissile consortium. One interesting point about the company is the minority ownership shares held by Boeing and Aerospatiale.

Among the major aircraft firms, severe resentment has resulted from the establishment, in the F-16 project, of US relationships with peripheral manufacturing firms outside the leading industries. These relationships, in the European view, create over-investment in short-term programs and under-utilization of major industrial capacity and sunk costs, all leading to even lower European productivity compared to the United States. The highest degree of acceptance will result from licensing and collaboration with the major factors in the European aircraft industry.

The other two German airframe companies also have some interesting collaborative experience. Dornier is the German partner on the Franco-German ALPHA JET program. VFW Fokker has been licensee for German production of the Sikorsky CH-53 helicopter; and most important, is a transnational German-Dutch company of which the Dutch arm has a leading role in the F-16 program. For the long-term, it seems likely that there will be further rationalization of the German aircraft industry, resulting in a greater concentration of military aircraft programs in MBB.

AIRCRAFT ENGINE INDUSTRY

The specification of an engine is the starting point for any licensing or co-development of a military or civil aircraft. There is only one aircraft engine company in Europe, Rolls-Royce, which has development capabilities that approximate those of the two principal US engine companies. The two other main European companies, SNECMA and MTU, are much smaller. Although they have impressive manufacturing and test capabilities on a selective basis, their R&D capabilities are very limited. The entire European aircraft engine industry has slightly over 90,000 employees, two-thirds of whom are Rolls-Royce, compared with over 150,000 in the United States. Even Rolls is constrained by limitations on R&D resources which have led to clearly identifiable penalties in product development and manufacturing development, especially in the manufacture of high-temperature turbine components. Nevertheless, the latest military engine, the RB-199, is a technically ambitious project presenting a system with operating temperatures, pressure ratios, and thrust-to-weight ratios roughly comparable to US technology. The maintenance of R&D capabilities at Rolls-Royce will continue to be a primary objective of the British government after nationalization.

Rolls has developed a complicated network of international collaborative relationships, both within Europe and with the United States. With several specific exceptions, Rolls' licensing relationships to and from the United States have proceeded reasonably well, if allowance is made for competitive frictions. Specific difficulties that have arisen in licensing arrangements can, for the most part, be traced to differing experiences with national user standards. For any future US initiatives in the licensing of military aircraft engines, the relationship of Rolls-Royce and MTU in the Turbo-Union consortium represents an interesting candidate for partnership.

SNECMA, the main French engine company, has only about 14,000 employees and somewhat limited R&D capabilities. United Technologies Corporation has a minority ownership in the company. SNECMA has, with

some US technical help, developed the new M-53 engine to power the next generation of supersonic fighters in France; and it has also formed with G.E. the CFM-56 consortium to develop and produce a 20,000 pound thrust (ten-ton) engine for the next generation of civil transports. In the view of the US engine manufacturers, SNECMA has excellent manufacturing facilities in selected areas (for example, in modern forging and casting techniques) and a thoroughly respected engine-testing capability. With the exception of the ATAR engine series for the current generation of MIRAGE fighters, future programs will be collaborative - primarily with Rolls-Royce and General Electric.

It would be difficult to prove, either in Britain or France, that new jet engine-testing duration or procedures differ significantly from the United States. With regard to the M-53 program, through the spring of 1976, 19 prototypes have accumulated some 5,000 hours of running time, including nearly 700 with afterburner.

In jet engine licensing, which evokes a number of difficult problems in military and industrial security, the French government and SNECMA have been willing to accept the compromise of receiving a "sealed" core engine from G.E. in the CFM-56 program, to which peripheral systems are added by SNECMA. This type of arrangement would, in most cases, be rejected out of hand by Rolls-Royce.

MTU in Germany is the chosen instrument for German participation in licensed manufacture of foreign jet engines and Germany's portion in Turbo-Union. Although the total capacity of the company is rather small, its metal-working capabilities are fairly well advanced (e.g., electro-chemical milling, electron beam welding). The principal programs, either current or planned, include the RB-199 collaboration with Rolls-Royce through Turbo-Union, probable participation with Pratt & Whitney and Rolls-Royce on the JT-10D engine to compete with the G.E.-SNECMA CFM-56, and continuing production of the G.E. J-79 engine (which powers both the F-4 and F-104). In addition, MTU participates with the French engine industry on production of the Larzac engine for the ALPHA JET trainer.

Finally, as the text of Volume III indicates, Turbomeca is an important potential collaborator for small and medium-sized engines.

TACTICAL MISSILE INDUSTRY

Overview

Tactical missiles are especially well suited to the technological skills, the industrial scale and capacity, and military requirements of the Western European countries. In addition, they offer the vitally important potential for large-scale export which is needed, by Britain and France in particular, to maintain defense industrial viability. For Europe as a whole, 50 to 60% of missile production is normally exported, and prohibitions on freedom to export would effectively rule out the prospect of most licensing or collaborative arrangements.

Tactical missile development and manufacture is, consequently, an area of considerable strength among European NATO countries and represents an area in which Europe considers itself the technological equal of the United States. Although there is considerable interest in future trans-Atlantic collaboration, the principal mode envisioned by Europe is one of co-development among equals with regard to more advanced systems, drawing especially on US advances in precision guidance and resistance to countermeasures.

As in aircraft programs, European tactical missile activity is characterized by a fairly high degree of collaboration. The principal example to date is Euromissile, the consortium of MBB and Aerospatiale tactical missile activities. Compared with the Panavia model, however, Euromissile lacks an independent technical and management staff. In addition, MATRA and HSD have formed a cooperative arrangement on the Martel project. However, as in the case of aircraft, no consortia have yet been formed joining Britain, France, and Germany in a unified program. It seems likely that this type of collaboration will emerge, possibly after the nationalization of the British aerospace industry and the potential fusion of the missile divisions of BAC and HSD.

British Tactical Missile Industry

In Britain, there are some 14,000 workers involved in tactical missile R&D and production, about equally divided between BAC and HSD.

In addition, the British electronics industry is capable of acting as prime contractor for SAMs and other tactical missiles. The leader is Marconi and its various operating elements. Marconi's semiactive radar guidance system for the XJ-521 British SPARROW and its participation in the radar and homing systems on SEA DART, MARTEL, SEAWOLF, and other missiles indicates a capability that is important in future standardization efforts. British capabilities appear to be particularly strong in SAM systems, especially for naval applications.

Two major trends in British tactical missile industry are apparent: first, the likelihood of eventual merger of the two principal missile divisions in Britain; and second, the growing favor with which the British government views collaborative tactical missile ventures within Europe.

French Tactical Missile Industry

In France, Aerospatiale and MATRA are the principal manufacturers. In the past, MATRA has concentrated on Air Force requirements while Aerospatiale was more concerned with Army requirements, but these distinctions may be diminishing in importance. Aerospatiale is the collaborator with MBB in Euromissile, which is the sales and management organization for three important programs - ROLAND, HOT and MILAN. These programs, in addition to the EXOCET anti-ship missile, are the major activities of Aerospatiale and are characterized by the prospect of long production runs, at fairly high rates, and large export potential. The US licensing of ROLAND II has, despite difficulties in the working relationship, provided an important boost to industry morale.

MATRA's principal strengths are in air-to-air missiles, as exemplified by the Super 530 long-range interceptor missile, which will enter operational service in 1978, and the R-550 close-in dog-fight missile, which reached operational status in 1975. These are national programs for the French Air Force, but their export potential is substantial. On a collaborative basis, MATRA and HSD developed the Martel ASM for both the British and French military services, with alternative

guidance systems. In cooperation with Thomson CSF, MATRA has also produced the CROTALE battlefield SAM, which was one of the contenders with ROLAND II for the US Army competition. MATRA has collaborated with an Italian firm, OTO-Melara, to develop the OTOMAT anti-ship missile.

German Tactical Missile Industry

In Germany, missile activities will probably be concentrated increasingly in MBB, and both German industry and government will, characteristically, keep pressing for further collaborative projects within Europe and with the United States. MBB's collaboration with Aerospatiale has been harmonious and has been of particular importance in the major programs to date. In addition to those already mentioned, the KORMORAN anti-ship missile has been developed in collaboration with Aerospatiale and Thomson CSF; and there is already discussion of a supersonic replacement, currently designated the FK-80, which would be a Franco-German collaboration but could also include other partners.* In addition, MBB is working on a long-range ASM for use against large or high-value surface targets, which would be carried on MRCA, and here there has been some interest in collaboration with the United States. The main projects at the moment are, however, MILAN, HOT, and other high-volume production activities.

Missile Licensing and Co-development Opportunities

European industry observers seem dubious, at present, about further trans-Atlantic licensing prospects beyond those which have already been established. In a number of tactical missile categories, US and European industries are in direct competition in world markets. There appears to be a general interest, however, in identifying collaborative opportunities for succeeding generations of tactical missiles, due not only to a further interest in a share in the US market but also due to recognition of US technological advantages in certain selected areas, particularly those related to terminal guidance.

*Hawker Siddeley Dynamics has shown an interest in such a partnership.

Consequently, while there are certainly a number of specific opportunities remaining for the United States to license existing US systems to various European customers, any venture in tactical missile standardization, intended to encompass all of the major countries, would probably require some element of co-development. This is particularly true if France were to be included in future projects aimed at standardization. Among types of future collaborative development activities that have been mentioned by European industry, the following appear to be the most significant:

A second-generation, short-range SAM to replace ROLAND, RAPIER, and CROTALE.

A third-generation anti-tank missile to replace HOT and MILAN in meeting standardized NATO requirements.

A medium-range SAM with very low-altitude capability and a high degree of resistance to ECM. Here, principal European collaborators might be the electronics firms such as Marconi and AEG-Telefunken.

More advanced AAMs in each principal category - e.g., high-altitude, high-Mach-number interceptor missiles as follow-ons to PHOENIX and Super 530; and close-in dog-fight weapons as follow-ons to AIM 9L and R-550.

A second-generation replacement of LANCE and PLUTON to fulfill the requirement for a 100-kilometer ballistic weapon. Such a system could be based on improved navigation and propulsion technology.

An anti-ship missile to replace HARPOON, EXOCET, and OTOMAT, in which the important specifications would be supersonic speed and increased range.

An anti-missile missile for ship defense.

There is a general recognition of US technological superiority in a number of specific areas of interest such as EO systems and miniaturized target seekers; large tactical missiles in the SAM and ASM roles; in cruise missiles; and RPVs.

Some European industry spokesmen express concern, based on the F-16 experience, that US industry might by-pass the established European missile industry and set up license relationships with firms having little

or no background in missile development or production. It is essential, in any licensing or collaborative arrangements initiated by the United States, to concentrate attention on the principal industrial groupings in a given category in order to further the objectives of unification and standardization.

SHIPBUILDING INDUSTRIES

In terms of size and turnover, the shipbuilding industries of the European NATO countries are much less important than the aerospace industry. European naval ship design and construction are concentrated strongly in Britain and France due to the fact that the navies of these two countries account for such a predominant share of operating surface ships and submarines. Britain and France together comprise about 67% of naval ship procurement expenditures among six Western European NATO countries.

The collaborative trend has, for a number of reasons, not been applicable to naval shipbuilding. There is a tendency for each country to direct all shipbuilding contracts to its own yards. In Britain, the government has made a decision in recent years to direct all new naval construction to commercial yards. In France, naval ship construction is performed in four government dockyards with the exception of some small diesel electric submarines and patrol craft which are constructed in private yards.

While Britain and France have tended to concentrate in recent years on fewer, heavier ocean-going surface ships in the frigate and guided missile destroyer categories, there appears to have been a general agreement that West Germany, the Netherlands, and Belgium would concentrate on lighter frigates as well as fast patrol boats and mine vessles for in-shore missions. (It should also be noted that France has joined with the Netherlands and Belgium in a collaborative project for a minesweeper).

There has been a general decline in shipbuilding capability in Western Europe. In 1964, there were 13 shipyards in Britain capable of producing naval vessels. By 1976, this number has been reduced to three

lead commercial yards plus three additional commercial yards. Although there is a possibility that the changing trend in naval warfare, towards the employment of a larger number of smaller platforms, may permit the European NATO countries to resume affordable shipbuilding programs to replace their aging fleets of larger-size vessels, the absence of advanced R&D and design capabilities may create a necessity to procure technology from the United States.

In Britain, defense shipbuilding accounts for about 31% of total shipbuilding. In the main British shipyards capable of naval shipbuilding, there are now about 45,000 workers.

Naval shipbuilding in France is confined exclusively to naval dockyards, which now have about 35,000 employees, of whom only about 12,000 are actually engaged in naval construction. Total turnover appears to be on the order of $650 million. Of the four major dockyards, Cherbourg concentrates on diesel and nuclear submarines; Toulon on repair, maintenance, and refit; and Brest and Lorient construct all naval surface ships over 1,000 tons. Although these yards are relatively busy, they are not operating at full capacity. One commercial yard, Constructions Mecaniques de Normandie, specializes in small boats such as fast patrol craft and minehunters. They currently have a contract to build 20 new fast patrol missile boats for West Germany.

In Germany, a relatively small proportion of the defense budget is allocated to naval construction; and the German navy is confined mainly to small craft for in-shore patrolling. Germany is the only NATO European country to order naval vessels from outside the country, as exemplified in orders for patrol craft from France and three guided-missile destroyers from the United States. About 30% of naval ship procurement funds have been spent abroad. Although there are five major shipbuilding companies in Germany, they have found it extremely difficult to continue competing with Japan and other commercial shipbuilding industries. Currently, the German shipbuilding industry, even with reduced activity, appears to be plagued by manpower shortages.

In terms of technology and capacity, probably the most logical potential future licensees or contractors for US purposes would be the three lead shipyards in the United Kingdom - Vickers, Vosper Thorneycroft, and Yarrow. As indicated by new designs such as the "HARRIER Carrier," British industry does retain technological capability and innovative capacity which can be responsive in future trans-Atlantic collaborations.

From the industrial standpoint, three collaborative prospects can be identified: first, an examination of the relatively few unique European designs - e.g., HARRIER Carrier - to determine their applicability to licensed production in the United States; second, given the current difficulties in US naval shipbuilding, the possibility of placing orders for construction at leading European private yards that are well capitalized and under-utilized (the three British yards are the main examples); and third, to examine the prospect of participation in the collaborative French-Dutch-Belgian minesweeper project, which is also of considerable interest in the context of EPG.

TANKS, ARMORED VEHICLES, AND SELF-PROPELLED GUNS

Britain and Germany regard themselves as the technological equals of the United States in tank development and manufacture, capable of strong independent judgments about technological alternatives. The European tank industries benefit from a strong automotive base and from relatively large military requirements as well as substantial export markets.

Qualified European observers make the following judgments about licensing or collaborative opportunities between Western Europe and the United States in the tank and armored field:

> Compared with the aerospace industry, where work-force stabilization is of the utmost importance in national policy-making, the situation with regard to tanks is based more closely on military requirements and technological alternatives.
>
> The European industrial view is that Britain, Germany, and France have been more successful in developing armored vehicles in recent years than the United States, especially in relation to the resources available. In their collective view,

European development efforts are not as fragmented as those in the United States; their military authorities have a clearer idea of what is needed and practical, a factor which has avoided such false starts as ARSV, T-95, and MBT-70; and European armored vehicle programs have been less vulnerable to changes in senior military personnel and policy.

The European view is that the quality of R&D facilities directly related to armored vehicles is about the same on both sides of the Atlantic, while static engine and vehicle test facilities are superior in Britain and Germany. Proving ground facilities are considered superior in the United States. The US lead in computer modeling of armored vehicle performance is also acknowledged.

Manufacturing capabilities are roughly comparable in the tank industry, with significant exceptions in some major components. British industry suffers labor and management problems in tank production just as it does in other defense industry sectors. German management of production has been extremely efficient, somewhat offsetting the high wage scales and difficulties in currency fluctuations.

Britain has been responsible for a number of major design innovations such as the new type of Chobham armor as well as triple differential tank steering systems and collapsible flotation screens. Other equipment pioneered in Britain includes APDS ammunition, two-axis electrical stabilized gun controls, supine driving position, non-reflective periscopes, and aluminum armor.

France has pioneered in automatic loading systems and oscillating turrets. France was also the only country which, during the 1960s, competed with the United States in the development of gun/missile launchers.

In general, Germany has not demonstrated any great originality in tank design but has been superior from the point of view of automotive performance and reliability due to more thorough detail design of components and testing. In recent years, however, the Federal Republic has also started a program of

research into highly mobile tanks with power ratios that are much higher than any other existing tanks. This trend will eventually produce some new and original designs.

With regard to other vehicles, one program of interest is that of self-propelled guns. The jointly-developed 155mm SP-70 is regarded as a serious challenger to SP equipment produced in the United States.

One divergent trend has been the development in all major European industries of wheeled armored vehicles, a category which the United States has not yet entered.

With regard to major tank components, one important category in which the United States has a strong lead is that of electronics-based systems for tanks. Britain, France, and Germany have been quick to follow US leads in such systems as laser rangefinders.

There is no equivalent in Europe of the cannon-launched laser-guided projectiles recently developed in the United States.

France has led in a number of specialized areas such as medium-pressure smooth-bore guns of 90 and 105mm caliber which fire fin-stabilized HEAT projectiles and which are particularly suitable for light armored vehicles. France is also now developing a high-velocity 120mm smooth-bore gun firing APFSDS.

In one particular category, US production scale presents a great cost advantage over any of the European countries.

The scale of commercial engine manufacture in the United States makes tank engines cheaper than those produced in Europe. (This is particularly true of the two-stroke diesels produced by Detroit Diesel Allison.) In addition, the greater development funds available in the United States have made it possible to develop a gas-turbine engine successfully, a trend which is not likely to be duplicated in Europe.

To some extent, the same judgment about cost advantage is true of engine transmissions.

In general, licensed manufacture of complete vehicles is not an attractive proposition for any of the major European countries. In recent years, licensed manufacture has been considered only twice. In both cases it was a US interest in obtaining a license from

Western Europe - first, in the possible adoption of the British SCORPION; and second, in the recent prospect of a license for LEOPARD II.

Manufacture of components under license is an entirely different matter which is accepted practice among all the major industries. Examples include US adoption of the British-designed 105mm tank-gun and licenses granted by Hughes for development and manufacture of laser rangefinders in Britain and Germany.

The greatest case for standardization and licensing arrangements can be made in tank-gun ammunition. One European view is that the most immediate opportunity for this purpose would be the licensing to the US of German or possibly French 120mm smooth-bore guns.

In the European view, if the US Army should decide to develop a new light-armored vehicle, there might be an opportunity to license the British 76mm medium-velocity gun or the 30mm RARDEN gun. An alternative might be a license for the French medium-pressure 90 or 105mm smooth-bore gun.

There are also further, if somewhat limited, opportunities for licensing US fire-control systems to Europe - e.g., stabilized gun control systems such as those manufactured by Cadillac Gage and Honeywell.

Because the tank industry is a mature industry closely associated with automotive production, classical forms of licensing of specialized components have been widely used, due to the capabilities of the different national industries to recognize new advances quickly and take advantage of them. The more current forms of collaboration that have been developed among aerospace industries do not apply to the tank industry, which is a much smaller and more intimate international community of industries. However, one important example of collaboration is that of Britain, Germany, and Italy in the SP-70 self-propelled artillery project. This is a collaboration which could be of potential interest to the United States for purposes of standardization. The SP-70 is a derivative development of the collaborative FH-70 155mm towed gun. For the three participating governments, it is designed to replace the US-built M-109 155mm howitzer. Industrial responsibility for the program lies with Vickers in Britain and

Rheinmetall and Faunwerke in Germany. When the gun goes into production, OTO-Melara in Italy will also participate. This is a situation of potential US interest.

SOME CURRENT INDUSTRIAL ISSUES

For European industry, the credibility of the American standardization initiative is inseparably linked with the establishment of a "two-way street." In the last 20 years, there has been a flood of US hardware and licenses from the United States to Europe and a trickle in the other direction. If the latest US standardization initiative comes to be perceived only as a Trojan Horse for a new wave of US licenses (e.g., F-16, F-18, AWACS, HARPOON, HAWK, SPARROW, etc.) then intra-European efforts to exclude the United States may intensify. For European industrial purposes, the two-way street will be defined as a sharing, according to pre-established formulas, of the costs and industrial work benefits, under the supervision of an established transnational body, in selected defense programs. In the sum total of such programs, the major European industries will seek a balance approaching parity in the exchange of products and services.

If licensing is the primary vehicle to meet the objective of standardization, then systems that are in late development or early production become natural candidates. For this reason, European tactical systems programs are identified that are now either in late development or in relatively early stages of production. This chapter has included a list of the European systems that could, in the next several years, be available for licensing to the United States as part of a two-way street. More details and a further discussion of the relevant industries is presented in Volume III. These systems include some that are technologically impressive, such as the naval SAMs in Britain, advanced AAMs in France, Franco-German anti-tank weapons, British armor and guns, French light armored vehicles, etc. However, to recite such a list even in outline is to recognize immediately the existence of competing US systems. European industry does recognize this fact and for that reason has tended to emphasize the need to reach beyond the competing systems of the current

generation and establish shared co-development programs for the next generations in each of the tactical weapons categories. Such an approach would not preclude licensing; but it would subordinate licensing within a larger co-developmental context. The current example of the two trans-Atlantic collaborations on ten-ton engines is useful, since these projects involve both co-development of the total package and specific licensing within that package.

The "interdependence" concept, formulated by DDR&E at the beginning of this decade, called essentially for separate and independent design and development, followed by competitive selection of a single system, for which production would then be licensed in each of the user countries. The current European industrial concept calls for initial agreement on joint specifications, followed by collaborative R&D and, ultimately a production program that typically involves two or more final assembly lines supported by a specialized division and cross-vending of subassemblies and components. Licensing has an important role in this process, especially in cases where existing major subsystems and assemblies (e.g., engines, avionics, homing heads, etc.) can be incorporated in a new system. Although this kind of approach may not, in many instances, be accepted in the United States, it has a long process of evolution in the European defense industries and they are not likely to abandon it.

Also of great potential importance is the European evolution of ad hoc inter-governmental organizations, such as NAMMO and NAMMA, to coordinate government oversight of the resulting industrial consortia. Experience to date in the licensing of ROLAND II to the United States demonstrates the need for the establishment of inter-governmental authorities to resolve technical issues and establish industrial product and manufacturing specifications and standards, contracting procedures, and security regulations in advance of major licenses or other collaborative projects. The tendency to push the resolution of these problems down to the industrial level is virtually certain to create frictions which could otherwise be avoided. The intermediary role of government offices or laboratories can be extremely beneficial, as demonstrated by the use of a USAF system program

office (SPO) as a clearinghouse for the resolution not only of technical but of management issues. The role of the USAF SPO in the case of the AVS program of the mid-1960s, as well as the activities of the F-16 SPO at the present time, indicate the value of such a group to oversee the work of industry.

Although it would be difficult, on any general basis, to support arguments that European industry workmanship is inferior to that in the United States in high-technology fields, there is no question whatever that differences in scale of R&D funding and production have led to US advances in manufacturing development which inevitably affect product development. For this reason, it is often difficult to carry out adaptations needed in licensed production from Europe to the United States; and it is essential that these issues be resolved by government authorities before contracting to industry. The US network of specialized service commands and laboratories can play an important role in this regard.

Another key point to observe, is that virtually all of the new or recent European projects in high-technology fields are collaborative rather than national, a trend that favors greater efficiency and unification in NATO defense industries in the long run. Collaborative arrangements made with consortia rather than national industries will demonstrate US interest in encouraging and strengthening this trend. The establishment of intra-European consortia is rapidly resulting in greater standardization in Premier Commandement Aerienne Tactique (1er CATAC) and in 2 ATAF and other forces assigned to the Central European Front. For this reason, the consortia represent a very logical focal point for new US initiatives.

In any case it is important for US industry to work with leading defense firms in Britain, France, and Germany as well as or even more than with companies that are geographically or industrially peripheral. The European defense industries have been very concerned over the differences in rates of productivity, both among the European countries and in comparison with the United States. To increase the overall level of European

productivity, they have been anxious to achieve economies of scale through collaboration, especially in high-technology programs. Consequently, reaction to the F-16 program has been adverse, because it harms total European productivity in two ways: first, by requiring capital investment in relatively small national industries where there is little long-term prospect for sustained aviation production; and second, by by-passing the major, well-capitalized industries of the three large countries, where additional work would lead to fuller utilization of their own capital resources. For future US initiatives in standardization, this is a key issue, requiring primary concentration on the major specialized industries.

With regard to French industrial attitudes, which are important to a widening of trans-Atlantic defense industrial collaboration, the relative ease with which Franco-American agreements have been reached on the CFM-56 and Mercure 200 civil programs indicates the absence of any basic psychological impediment to major collaborations, especially those that offer some hope of long-term beneficial effects on industrial capabilities and employment stability. The lessons to be derived from the Franco-American civil aircraft negotiations are related to the issues of: the promise of increasing work for under-utilized production lines; potential access to the American market; and collaboration on a relatively full-partnership basis. To the extent that these conditions can be met in collaboration for defense standardization, French cooperation can probably be expected.

For all Europeans, the issue of domestic employment is fundamental in all current industrial planning. Stability in employment is more important than profits. Licensed production of other country weapons designs will therefore almost always be more attractive than direct purchase as long as production capacity exists that can absorb the employment resulting from licensed production. Also, there must be the expectation that employment will continue over a reasonable period and can be sustained beyond the life of individual projects. For the big three (Britain, France, and Germany), this expectation depends on sustaining a substantial research and development capability and, for Britain and France in particular, a share of extra-NATO sales. If US industry is not to be

increasingly shut out of European defense markets and standardization is to be achieved on a trans-Atlantic basis, this means the US must be prepared to accept more licensed production of independent European designs or enter into more extensive co-development arrangements.

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Chapter 6

CANDIDATE NATO REQUIREMENTS FOR LICENSED PRODUCTION

GENERAL

The purpose of this chapter is to review, summarize and select the principal national and agreed NATO requirements and procurement programs that could be candidates for co-production and licensing in the late 1980 to 1995 time frame.

A review of NATO documents pertaining to standardization efforts in the past, and particularly the reports over the past five years of the Conference of National Armaments Directors (CNAD), makes it clear that there has been a continuing effort to identify candidate items for NATO standardization and that many of these items had or have co-production and licensing potential. Although there have been some successes, there have been significant lost opportunities, resulting in trends to de-standardization despite efforts to achieve agreement on standardization. Unfortunately, the records do not make clear what might have been done to bring together more of the separate national development efforts.

Any selection of candidate NATO military requirements and procurement programs for licensing opportunities should take account of past difficulties. Such selection should also consider the manner and degree to which current revitalized standardization procedures may make some candidates more promising than others or may influence the timing of steps toward standardization of selected systems through co-production and licensing. Equally important are the past and ongoing information exchanges and attempts to coordinate standardization actions within NATO, such as in the CNAD and the Military Agency for Standardization (MAS).

These exchanges have proven both time consuming and difficult but can play a key role in surfacing problems and in facilitating early resolutions. Further, they do provide an established source of high potential items for agreement (or disagreement) pending the results of two current standardization initiatives planned as part of the revitalized efforts. The first is the better exchange within NATO of "national analyses of future missions and system needs, of national long-range replacement or procurement plans and of national procurement programs" proposed by the Defense Planning Committee (DPC) (Ref. 1). The second is the work of the European Program Group (EPG) in coordinating efforts among European states to clarify requirements and procurement time schedules. Although the latter two efforts above may modify some current standardization opportunities, this chapter does not try to anticipate their outputs, but rather draws candidates from information available now.

The approach taken was to review and assess current standardization accomplishments and ongoing potential candidate programs against the priority goals of the three major NATO Commanders (MNC), which are stated in terms of interoperability (Refs. 1 and 2). Past statements of such requirements were also reviewed to evaluate trends and changes. The most complete records and details on NATO approaches to requirements, bilateral and multilateral cooperation, and on unresolved parallel or comparable developments are contained in the reports of the CNAD and its established Support Groups. These were used with the recognition that they are better records on the details of agreement than on the details of disagreement. In particular, information on diverging national programs addressing similar operational requirements, noted in such documents, do not provide much insight on the rigidity of the national positions and how they could be adjusted to reach agreement on standardized or interoperable NATO equipments if there were high confidence in reaching mutually acceptable co-production and licensing agreements.

Additional information on candidate requirements was obtained from a review of US development programs on systems for primary utilization by US elements within NATO, and from review of systems noted or highlighted as potential candidates by European members of NATO and the

European Program Group. All were then considered in terms of their schedules for fielding, practicality of co-production and licensing, and their relationship to the goals of better use of NATO resources and enhanced effectiveness of NATO forces.

Table 1 summarizes the areas that are most frequently reported in NATO standardization and coordination reports. Equipment programs range from essentially unilateral, to bilateral, to multilateral. Some do not hold promise for early standardization action, while others are either in active standardization programs or show potential for agreements.

The succeeding sections report those items identified within each of the four combat groupings (Land Combat Forces, Tactical Air Forces, Naval Forces, General) that either have high potential for standardization through co-production and licensing or have such high payoff in force interoperability or economics that priority US emphasis should be given to them.

A focus on candidates in terms specifically of licensing potential inevitably leads to systems in late development or early production. Unfortunately, it is just such systems that are most apt to have involved decisions by the sponsoring nation or nations to proceed in the absence of NATO standardization agreements. While it is possible to identify some systems where military requirements are not yet firm or standardized and design/development options are open, such systems — by their nature as early development programs — do not present obvious licensing opportunities. The resulting list of candidates is thus narrower than anticipated and excludes some general requirement areas listed in Table 1. Where no clear candidates could be identified, consideration was given to longer term requirements and possible future cooperative or European developments with co-production and licensing options.

Each area will be discussed in some detail to establish the bases for the proposed approaches, with one exception. There are obviously specific communications interoperability needs associated with naval, air, or land combat as well as those involving multi-service/multi-nation factors. The most critical current problem and the one that will

Table 1

AREAS OF ONGOING STANDARDIZATION COORDINATION

LAND COMBAT FORCES

Light & Medium Inf. Wpns	Surface to Air Missiles
Surface to Surface Arty	SHORAD
Tanks	Rocket Systems
Antiarmor	Artillery Fire Control
Ammunition	Helicopters

TACTICAL AIR FORCES

AWACS	Air to Air Munitions
F104 Replacement	Air to Ground Munitions
Advanced Landing & Approach	Drones/RPV's

NAVAL FORCES

ASW Torpedo	Defense Against Antiship Msls
Sonobuoys	Antiship Missiles
Hydrofoils	Medium SAM's
Naval Gun	Mines and Countermines
Point Defense	Frigates
Shipborne V/STOL	Lt Wt ASW Helicopters

GENERAL

Communications	Navigation & Position Finding
Data & Interfaces	Electronic Warfare
Fuels	Identification
Surveillance	Target Acquisition

influence many future communication and data interface decisions, involves tactical multichannel systems. This has been treated as a Tri-Service or general item. The ground based air defense systems also cannot be treated in isolation from other aspects of overall air defense concepts, particularly from AWACS. Those systems selected for emphasis, however, are operated by US ground forces and have therefore been included as land combat items.

LAND COMBAT FORCES

The pattern of past accomplishments on standardization and interoperability for NATO land combat forces, their current status and projected needs and opportunities can be addressed in two general groups. The first comprises items having high volume and significant combat effectiveness implications such as light and medium infantry weapons/ammunition, artillery weapons/ammunition, ground based air defense, tanks and their main gun, antiarmor and communications systems. The second group involves either lower volume items or those for which standardization/interoperability has not been a major issue. This includes such items as night vision devices, trucks, engineer equipment, and a large number of components and systems in the combat service support area. This chapter concentrates on the first group. Tanks and tank main guns are not addressed since they are already well identified in the XM-1/LEOPARD II coordination. Note is made, however, of UK-FRG cooperation toward a common tank for the 1990's and the unknown effects this may have on post-1990 US and NATO tank standardization.

Each of the remaining major land combat items will require either a confirmation that the military need against which it is being developed will continue or agreement on a mutually acceptable basis for standardization of new items. These factors will be highlighted as appropriate in the separate sections that follow.

Antitank Weapons and Ammunition

Differences Between Two Classes. Antitank weapons, not including tanks themselves, can be generally divided into two classes: (a) high density weapons found at battalion level and below; and (b) high mobility

weapons found at organizational levels above the battalion. The high density class includes such weapons and ammunitions as rifle grenades, grenade launchers, recoilless rifles and guns, and light ground mounted or ground vehicle mounted guided missiles. The high mobility class includes missile firing helicopters, gun and missile firing fixed wing aircraft, and artillery munitions having an antitank capability.

The need for standardization of both classes or weapons and ammunition is great but the reasons differ. For high density weapons the large numbers involved, their expenditure in peacetime training and the fact that many also function as infantry direct fire weapons all combine to produce relatively large peacetime and war use and hence large inventory objectives. This in turn implies the need for economy of scale in their production and procurement. Given sufficient supplies for each national force and a reliable re-supply system, the tactical benefits of standardization are not compelling. The weapons are imbedded deep in the national force structures and the tactical importance of having standardized antitank equipment may not be easily proven on a weapon by weapon basis. Thus, the arguments for standardization for high density antitanks weapons and ammunition stem principally from economic and logistic considerations.

The second class of antitank systems are characterized mainly by their high mobility and tactical flexibility. Helicopters and fixed wing aircraft can be shifted from point to point over a wide frontal area. Artillery weapons can also impact wide frontal areas and this, together with the possibility of air delivery of antitank ammunition, results in potential wide coverage. For both artillery and aircraft the tactical advantages of standardization are obvious. The ability to replenish the ammunition stores of rotary and fixed wing aircraft at many different bases or resupply points, regardless of national origin, permits tactical utilization far beyond what would otherwise be possible. Finally, the problem of standardizing delivery means overlaps with that of the standardization of ammunition. The delivery means and such ammunition as missiles and antitank artillery ammunition are very expensive. Thus standardization should be highly cost effective in facilitating their wider tactical use.

Current Systems. The antitank weapons used by the NATO nations uniformly employ shaped charge warheads to penetrate tank armor. These warheads differ in design, weight and diameter, with weight and diameter being by far the most important characteristics. However, while using the same type of warhead, NATO antitank weapons differ widely in the means by which they are propelled and guided to their targets. Propulsion systems range from the impulse imparted by a blank rifle cartridge to various types of guns and rockets. Differences in guidance means are even larger, extending from a soldier's estimate of angle and azimuth to systems that cause the projectile automatically to follow the firer's line of sight to the target. Even more complex guidance systems are currently reported to be in the final stages of development.

Inherent in the difference in guidance mechanisms are large differences in cost. Where guidance is accomplished by visual aiming and range estimation and the system uses drag or spin stabilized projectiles, the cost is low. Where it is done by the firer controlling the projectile or missile in flight by a wire data link, the cost is higher. Finally, where automatic tracking and computer generated signals hold the missile on firer-target line-of-sight, the cost is very much higher. Roughly these relationships are a few cents out of $50 to $100 per warhead delivered for ballistic ammunition, a few hundred dollars out of $1000-$2000 per warhead delivered for wire guided missiles, and $2000-$3000 out of $5000-$6000 when automatic tracking is used. These cost relationships have two major impacts. First, because of the high cost per missile fired, every attempt is made to maximize the weight and diameter of the shaped charge warhead. This limits their ability to be man portable by infantry. Second, the high cost systems are regarded as single purpose weapons. The basis for the numbers procured is mainly the number of tanks in the enemy threat and the organizational distribution needed to meet this threat. This contrasts strongly with experiential based "day of supply" procurement objective for less costly dual purpose antitank weapons.

Current Standardization. The only antitank weapon to achieve any high degree of common usage by the NATO alliance since the introduction of the US 90mm BAZOOKA and the 106mm recoilless rifle in the 1950's has been the Swedish designed and manufactured CARL GUSTAF 84mm recoilless rifle. This man-portable weapon has generally been judged to be clearly superior to designs produced by the members of the NATO alliance, including the US. The fact that many NATO nations have chosen this weapon over nationally sponsored developments or weapons available from other NATO members indicates that effectiveness can play a major role in weapons selection. The failure of NATO as a whole to design better man-portable antitank/infantry direct fire weapons and to achieve wider standardization must be regarded as a sharp disappointment.

With respect to missiles, France, the FRG and the UK achieved early design leads over the US and went into production with firer controlled wire link guidance. Since these missiles (SS10, SS11, COBRA and SWINGFIRE) were procured throughout the Alliance (including the US), a limited measure of standardization was achieved. However, there was continuing doubt in the US that firer proficiency with this type of guidance could reach a level that would justify the cost per missile. As a result, while the European nations were going into production, the US was developing missiles with more sophisticated guidance means, a process that produced TOW and DRAGON. There were also parallel developments in Europe, and the French MILAN, a computer guided man-portable missile, became available at about the same time or slightly in advance of the US DRAGON. It was considered for use by the US but rejected on the grounds that it required a greater manpower expenditure than DRAGON. This period also saw development of the German HOT missile, which largely parallels the capabilities of TOW; the HOT has just completed operational tests in Europe.

As a result of these essentially concurrent competitive developments, there is little immediate prospect for standardization of antitank ground mounted or vehicular mounted missiles. Since these same missiles are used for rotary wing aircraft armaments, there is also little chance that these high mobility systems will achieve any degree of standardization.

As for fixed wing aircraft armaments, there is some prospect of current or near future standardization. The US has abandoned development of WECOM 30mm aircraft gun ammunition in favor of the French ADEN-DEFA round. However, the FRG still intends to develop and install a 27.5mm gun on the MRCA. With respect to antitank missiles for fixed wing aircraft, product improvement to the US MAVERICK would probably be the most cost-effective NATO-wide course of action. However, it is likely that European consortia will undertake competitive developments.

Small Arms and Small Arms Ammunition

General. Small arms are the basic weapons carried by NATO's infantry forces. They contribute in a major way toward the effectiveness of those forces. Also, they serve as a symbol of national pride and, if standardization could be achieved, of Alliance solidarity.

The development and procurement of small arms does not bulk large in the costs of a modern armed force. The US small arms research and development budget ranges between four and ten million dollars per year, and an army of 200,000 men can be equipped with rifles and machine guns for about the same cost as the armored vehicles needed for a modern tank battalion.

On the surface the design and manufacture of modern small arms does not appear to be complex or difficult. The basic technology used has been available to designers since about 1900. However, small arms design is an art rather than a science and is dominated by a few prominent designers -- Kalishinkov in the USSR and Stoner in the United States being contemporary examples. Small arms design problems are much more complex than they might appear.

Finally, the users' definition of the needed characteristics for small arms are the subject of continuing debate. Needs with respect to wounding and penetration capability as a function of range are particularly unclear as are the values that can be placed on light weight and automatic versus semi-automatic fire weapons.

Definitions. Small arms include side arms, submachine guns, rifles, grenade launchers (sometimes integral to the rifle) and machine guns. Machine guns mounted on tanks are also considered to be small arms, but only in calibers up to 0.6 in. Another weapon that is important in modern small arms is the assault rifle, the design objective of which is to provide many of the capabilities found in the submachine gun, the rifle and the light bipod mounted machine gun.

Background. Designs and techniques used in small arms have not changed greatly in the last 40-70 years. For example, a recent tank coaxial machine gun competition in the US involved a design based mainly on the work of John Browning prior to World War I as well as a German design first seen in World War II. One of NATO's first standardization objectives concerned small arms, but this was also one of the Alliance's first and most serious failures.

To comprehend this failure the tactical and equipment developments and trends that occurred in infantry combat during World War II must be considered. The German Army introduced the first assault rifle in 1942. It was an automatic/semiautomatic fire weapon, which used an intermediate impulse round. This round had a higher velocity than the submachine gun or pistol round and a lower velocity than the regular German rifle round. Its advantages were threefold:

- the weapon could be controlled in automatic fire and also be used in semiautomatic fire at reasonable ranges when needed,
- the weight of ammunition was reduced by about 50% in comparison to other automatic weapons, and the infantrymen could carry a larger supply,
- the submachine gun could be eliminated from infantry small units.

The concept of employment of this new type of rifle was particularly suited to German basic infantry tactics which had emphasized the importance of automatic fire in small units since World War I. Automatic fire required a second kind of ammunition at the small unit

level but the Germans believed this was a small price to pay for the added capabilities of the assault rifle.

The Russians appear to have reached the same conclusions as the Germans. During World War II they introduced the M43 intermediate cartridge and in 1947 they introduced the AK 47, an assault rifle similar to the German World War II models. Warsaw Pact forces have used the intermediate/high impulse small arms mix since that time.

In the West the German experience had not gone unnoticed, and after World War II both the UK and Belgium began development of assault rifles. These rifles were based on the use of an intermediate impulse round and when the issue of NATO standardization arose this round became a prime candidate. The United States, however, rejected the entire concept of an intermediate impulse round and forced the UK and the rest of NATO to adopt a high impulse round. The US held out the hope that if this were done, it would adopt a European designed rifle. After extensive tests, however, the US did not do so and adopted instead what many consider to be an inferior US design.

The US further compounded the problem by then adopting the M-16, initially as a weapon "only for Special Forces and Southeast Asia" but later as an Army-wide replacement for the M-14. The M-16 fires an intermediate impulse 5.56 x 45mm cartridge and thus, while following the German World War II and the Russian post World War II approaches, represents another example to the NATO Allies of independent US action.

Current Standardization. All the NATO countries except France use the NATO 7.62 x 51mm cartridge in both rifles and machine guns. All except the US use 9mm ammunition in their submachine guns. These ammunitions are in theory interoperable in the three major rifle and three major machine gun types in use by NATO. The same is true for the several kinds of submachine guns using 9mm ammunition. In addition, machine gun belt links are also intended to be interoperable. A significant degree of interoperability has probably been achieved, although the several kinds of mechanisms that must fire a single kind of ammunition make this uncertain in particular cases.

Future Prospects for Standardization. Agreement has finally been reached in NATO that a second caliber of rifle and machine gun ammunition will be standardized. Presumably this will be an intermediate impulse round, or a new design that accomplishes the same purposes as an intermediate caliber. To this end a NATO test manual has been published and a Memorandum of Understanding negotiated (Refs. 3 and 4). However, in spite of such indication of progress the situation for the near future is not bright. This is because the US already has a large investment in its own intermediate impulse 5.56 x 45mm cartridge, one that it is not likely to abandon quickly. In the event that NATO nations do not adopt that cartridge the adoption of still a third rifle and machine gun cartridge could initially lead to destandardization rather than standardization. Addressing uncertainties regarding US intentions, the US representative to CNAD has stated that "the US expected to adopt the new NATO standard round which would be established as a result of the common assessment programme" (Ref. 5).

The key to NATO cooperation and standardization probably lies now, as it did in the 1950's, in US willingness to adopt European designed mechanisms in return for European adoption of a US designed cartridge. The proposed purchase by the US of the MAG 58 coaxial machine gun and the tenacity with which that position has been held in the face of some Congressional criticism are encouraging signs in this regard. The US selection of 5.56mm as the caliber for the Squad Automatic Weapon System (SAWS) and its negotiations with Fabrique Nationale for the development of a firing mechanism is also a good sign. However, the concurment development of an "in house" US candidate unfortunately may remind the Europeans of the difficulties of the 1950s. The door to the SAWS design competition should be opened wider to European participation; wider US competition would also be highly desirable. This could avoid the possibility of a last minute "sleeper" US candidate that might again raise European suspicions of US intentions.

The testing manual and the MOU may lead to standardization or they may not. The tests described do not differ greatly from those conducted in the 1950s, and the sharing of costs of the evaluation program

will lead to better relations only if the program is conducted in an atmosphere of the complete absence of conflicts of interest.

The Belgian position regarding their licensing and data rights with respect to the MOU include:

- the obtaining of a preliminary production order by Belgian industry,
- payment of a given amount upon signature of the contract granting the license,
- remuneration for the supply of a technical record,
- royalties,
- freedom of the license holder to manufacture more than a given quantity without additional cost.

Complications from these and differences with and among the licensing approaches of other participants remain to be seen.

Ground Based Air Defense

General. Ground based air defense systems provide several strong potential candidates for continued or expanded standardization and co-production/licensing. Since the ROLAND II agreement is in the process of implementation, it will not be addressed other than to note that it is an example of both the feasibility of licensed production and the problems inherent in "cross Atlantic" transfers of technology. It is not within the scope of this chapter to discuss the details and causes of the changes involved in setting up ROLAND II for US production. Many commentators have noted various problems resulting from or giving rise to these changes. For other candidates for the "two way street," the ROLAND II experience suggests that such problems can be significantly reduced if there is either greatly increased coordination of US and European production standards and methods, European production to US standards of a European developed item, or earlier decision and more detailed cooperative production planning on items incorporating recent technology. The last is considered key to avoiding the pressure on either side of the Atlantic, to reengineer. It would also establish a

better base for a common configuration control mechanism for future configuration control.

SHORAD (Light Missile). The decision by the US to adopt the ROLAND II has greatly stabilized the SHORAD missile situation in NATO and has established an excellent basis for agreement on what should ultimately replace the ROLAND, CROTALE and RAPIER. It is not yet clear if this should be a system similar in concept but better in performance or if changes in air defense requirements may result in a different approach. The significant point is that these current systems have essentially the same anticipated life and that there is now the opportunity to work toward a common approach to the total air defense problem. Since no country has yet identified a requirement for a new light SHORAD missile system before 1989, this area is a good candidate for a high visibility coordinated "requirement to production" program. Such a program should be based on consideration of many of the suggested approaches to shared development and production once the requirements are better defined. The chances for success of the program would be greatly enhanced if those nations not yet committed to a light SHORAD missile system restricted their choices to the ROLAND, RAPIER, or CROTALE, particularly the Italians who have deferred to 1977 a decision on their own developmental SPADA and MEI systems.

SHORAD (Gun). The situation with regard to standardization on a common forward air defense gun is less stable. The US commitment to consider the FRG 35mm Armored FLAKPANZER, if a decision is made to replace the VULCAN 20mm with an automated gun system, holds promise if it results in a strong conclusion favoring the FLAKPANZER. If not, the US would be in the difficult position of rejecting a weapon that the FRG plans to field with Belgium and the Netherlands. It has been difficult to find any indication of anticipated results, probably because of inferences that a FLAKPANZER decision may have interactions with other decisions.

If the decision is reached that the US will go a different route than an automated gun system in replacing the VULCAN, the standardization issue will focus on how that, as yet unknown, choice fits into

NATO air defense. If the decision is in favor of an advanced automated gun and the FLAKPANZER is accepted, several options appear valid. The first — appropriate primarily if the FLAKPANZER is intended solely for US forces with NATO — is FRG production to agreed US standards. The second — if the FLAKPANZER was intended for broader US applications including possible Marine Corps use — would be co-production with license to a US producer for at least those quantities not intended for use in Europe or with NATO committed forces.

Medium and High Altitude Air Defense (Missile). The potential for standardization on future medium SAMs involves, for the US, the role of SAM-D. This is being addressed within NATO in several forms. The lead efforts are the US-FRG and UK-France studies of the role of SAM-D after the in-service period of NIKE-HERCULES and of SAM-D or other advanced technologies (Ref. 5). Another effort is an assessment of anticipated performance and cost of paper systems, compared to the Improved HAWK and SAM-D. In addition to these efforts, the NATO Tri-Service Group on Air Defense (TSGAD) is conducting a study of the overall air defense mix, with special consideration to the tradeoffs associated with the employment of an airborne early warning and control facility.

In summary, decisions all the way from requirements determination to the fielding of the next generation of SAMs are still open and will not converge easily within NATO. Moreover, analytical studies do not yet offer a logical narrowing of options that will be acceptable to all. The course of action preferred by the US appears to be to coordinate SAM and AWACS to ensure a viable air defense posture, and to consider all feasible licensing and co-production options for SAM-D. The Spring 1977 CNAD meeting may better focus the alternatives but, in light of the SESAME and AWACS factors, this is not as promising as once anticipated. (SESAME refers to the two-year UK-France study on a SElected SAM system for Europe.) Because of the high costs involved, the criticality to NATO of a viable air defense system and the long term impact of fragmented and incompatible system decisions, air defense is a continuing priority area for standardization despite its difficulty.

Tactical Communications

General. Communications presents both a critical need for interoperability and combined challenges/opportunities for standardization. The tactical multichannel aspects, as noted at the beginning of this chapter, are presented as a Tri-Service issue. Single channel, primarily net radio, communications also have Tri-Service implications; however, their high density in land combat forces makes it appropriate to address them here.

Net Radios. Strong past and continuing NATO efforts on coordination and standardization in this area have focused on the interoperability of ground force net radios. Differing time schedules among NATO forces for fielding of equipments incorporating advancing technology have presented a continuing problem, but not to the extent found in multi-channel. The US Army is currently initiating action for the "next generation" of its tactical net radios. While not advanced to the point of identifying specific items for potential co-production and licensing, the schedule does provide time for such considerations in a past and current environment of shared concern with NATO allies on interoperability. Existing STANAGs could be built on to develop a NATO approach that would retain current interoperabilities and address a NATO transition plan for next generation equipments that facilitates rather than inhibits agreement. Cooperative/shared development, co-production, licensing or direct purchase of equipments developed to common requirements all show promise due to the high level of European technology in most of the required areas.

Role of STANAGs. Possibly more than any other area, communications interoperability is dependent on the development of and compliance with detailed STANAGs covering essentially all aspects of the communication process. Only a brief, but representative, listing includes such items as: message formatting, procedures, signalling, frequency allocation, power, modulation, detection. Some can be conceptually developed or derived as modification on existing STANAGs. Others may evolve from agreement on one approach or design from several candidate applications

of new technology. The manner and skill with which the US participates in NATO communication (and data interface) STANAGs may determine the success or failure of efforts on communications interoperability, including selections of components for co-production and licensing. It is probable that European perceptions of US use of STANAGs to foster US designs and US equipments at the expense of theirs would lead to fragmentation or only selective compliance. On the positive side, US compliance with STANAGs would demonstrate that the US is looking for means of achieving interoperability in terms that Europeans understand and that it is prepared to make long range commitments toward that end.

TACTICAL AIR FORCES

General

The consideration of candidate areas for co-production and licensing associated with tactical air forces is dominated by the combined high dollar levels and political aspects of the F-16 and the proposed AWACS programs. It is unlikely that any imminent new systems will approach their scopes as standardization candidates. Since these are solely US developments, this analysis has searched for candidates that might be viewed by Europeans as representing the other direction in the "two way street." There are, of course, additional US systems that could be licensed for production in Europe, but especially in view of the F-16 and AWACS programs, Europeans are far more interested in US adoption of European developments and designs at this moment.

As noted in Chapter 5, the European aerospace industry shows growing effectiveness in collaborative development and production of tactical aircraft and air weapons. The true measure of the problem, however, is that there are no major US tactical air system requirements for which a US system has not been developed or is in development. No reference has been found suggesting US procurement in the near or mid term of major European developed systems other than the HARRIER. It is concluded therefore that the greatest promise lies in lesser programs. Even these are not clear, since references have been found only to general areas without detail on status and schedules for action. If progress

toward standardization and interoperability is to be made in the next generation of tactical aircraft, the US may need to take initiatives to apply European developments. Candidate areas are listed below in the context of their appearance in CNAD reports and not as well defined hardware candidates.

Standardized Armament, Interfaces, Subsystems, and Associated Ground Equipment for F-16, JAGUAR, MRCA, and Other Aircraft

This grouping in particular is representative of the problems to be resolved. While UK developments in air to ground missiles show promise, MAVERICK improvements are being considered by the US. Standardization on a UK landing and approach system has been suggested as offering benefits in use of European civil airfields by NATO military aircraft, but this has possible ramifications for future US civil systems. No indication could be found of active work on the problems, but the broad area was stressed by the CNAD as deserving attention by all nations involved. They are listed here for that reason, and because actions toward agreement must start now, if not underway, if cross-servicing and interoperability opportunities are to be identified and carried out for the aircraft listed.

Identification Systems

This too is an area that has been consistently listed as demanding a standardized approach for interoperability of air, air-ground, and air defense. Although there do not appear to be imminent candidates for a long term solution, the US may stress this area as offering opportunities for cooperation in the development and production of components between the US and a consolidated European effort. The relationship to AWACS, as well as to the data-communications interfaces associated with AWACS, and the spectrum of air defense weapons probable within NATO for an extended period make this an area of continued need for cooperation and agreement into the 1990's.

European Developed Special Purpose Munitions and Submunitions

This has been frequently identified as an area for potential European lead and US application. No reference could be found in the

NATO documents examined to specific actions that might lead to early decisions. The documents indicated that coordination was continuing. The area is therefore listed as one requiring attention and resolution. In particular, if there are aspects of this area requiring special treatment for the F-16, and possibly coordination with the countries currently committed to the F-16, they should be addressed in concert.

NAVAL FORCES

The prospects for NATO-wide standardization of selected naval systems and associated co-production and licensing opportunities are greatly influenced by the differences in perceived naval missions and naval force makeup among the members of the Alliance. The US, UK and France represent the major portion of the "deep water" interests of NATO, with the UK and France also reflecting shared "shallow water" or coastal interests with other members of the Alliance. The Mediterranean members have somewhat differing requirements and approaches to that area, both among themselves and with the US and UK.

Despite these differences, activities among the naval forces and within the CNAD have pointed toward the identification of common requirements and the coordination of system approaches.

Despite general agreement on the desirability of commonality in ASW torpedoes, with a minimum goal of interoperability among NATO naval forces, several issues appear unresolved and troublesome. One is the question of single or dual torpedoes for shallow and deep water operation. The second is the timeframe for decisions/selection and the manner in which competition among several national approaches can be resolved.

In addition to the above, for which there have been multinational interest and coordination, there are other naval systems that are being jointly considered and coordinated but with reduced numbers of direct participants. Examples that have or may develop standardization potential include hydrofoils, frigates, naval guns, light weight ASW helicopters, mine-countermine, shipborne V/STOL, and sonobuoys.

MULTICHANNEL TACTICAL COMMUNICATIONS SYSTEMS

Multichannel tactical communications systems, as well as net radios discussed previously, are obvious candidates for NATO standardization or interoperability. The status of interoperability of the multichannel programs, with six differing national approaches,* was the subject for a Fall 1976 report by the International Staff of NATO to the Military Committee and Council. Hopefully, movement can be started toward greater interoperability of the different multichannel systems.

While it is doubtful that current differences among the European approaches will be resolved in the near term, the shared problem of interfacing a full mix of different systems may force compromises in the separate system designs. To the extent that this leads to standard interface equipment designs, rather than separate national approaches to interfacing its equipment with others, movement would be started toward standardization. Further, the interface equipments might then become primary candidates for co-production and licensing.

The US position and actions should remain flexible while NATO continues to explore interim and longer term solutions. A premature acceptance of undefined "interface" equipment as the total interim solution should be avoided until all possible early consolidations/reductions of competing systems have been addressed. The US should be prepared, however, to consider European production or co-production of such interface equipments as are standardized and applicable widely within a mixed system. Similarly, the US might be prepared to offer co-production or licensing of TRITAC components, possibly modified, if such would contribute to greater interoperability and satisfaction of each country's requirements.

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*TRITAC (Delta Modulation): United States (1976 experimental)
PTARMIGAN (Delta Modulation): United Kingdom (1983-)
RITA (PCM): France and Belgium (1976-78)
AUTOKONETZ (PCM): Germany (1976-)
ZODIAC (Delta Modulation): Netherlands (1980 - replacing interim)
Experimental (Delta): Italy (1977-)

Stress should be laid on the necessity to coordinate future system planning and to avoid decisions to defer or postpone, and thus complicate, efforts to achieve optimum interoperability.

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Chapter 7

LICENSED PRODUCTION AND THE GOAL OF NATO STANDARDIZATION

THE TWO-WAY STREET REEXAMINED

Standardization is a means, among allies, to:

a. Achieve military interoperability.

b. Transfer military technology.

c. Maintain competitive R&D.

d. Sustain a viable military-industrial base.

e. Effect economies in the allocation of R&D resources.

f. Effect economies of scale.

These goals almost always involve tradeoff choices that are distinctive to the type of weapon or equipment under consideration. Therefore standardization, including standardization through the device of licensed production, generally must be approached on a case-by-case basis rather than by some all-embracing program to enforce common procurement by an international or supranational mechanism or by some common market device. The ease with which licensed production can be accomplished, however, and therefore the likelihood of its successful use can, with effort, be improved. This is discussed later in this section.

Standardization has been linked in official pronouncements as well as in general literature on both sides of the Atlantic with the slogan "two-way street." If the two-way street means principally offsetting direct purchase of major weapons and items of equipment across the Atlantic, it does not seem to be readily achievable for several reasons:

a. Both sides of the Atlantic can afford and probably need, for security and procurement rate reasons, separate production lines for many critical weapons and items of equipment.

b. It is probably not in the interest of either side of the Atlantic to make key industries dependent on large, specialized armaments sectors.

c. The US, despite exemptions to the Buy American Act, will continue to want to maintain something approaching autarky in much of the weapons supply for the foreseeable future.

d. It is probably in Western Europe's interest (and reflexively in the US interest) to maintain approximate autarky but on some more rationalized and integrated basis.

The two-way street is likely to mean a decrease in sales of weapons and equipment to Europe from the United States. However, a two-way street licensed production of commonly selected designs can be a key (and perhaps the only realistic) device for facilitating trans-Atlantic standardization of major weapons and items of equipment. Offsetting direct purchases of components may very well be involved in licensed production arrangements despite the opposing reasons a-d listed above.

Direct purchase of low volume and/or specialty weapons and items of equipment may continue to be economically attractive at a NATO-wide level but will probably involve increasing demands for some mix of apparent or real offsetting direct purchase (e.g., MAG-58 vs F-16) and licensed production.

Almost any licensed production arrangement involves hard negotiations on the economic aspects of work sharing and market sharing, on the flow of information and know-how and compensation therefore, and on security and policy aspects of extra-NATO sales. These are obviously more difficult when the licensed production involves countries that have competitive design and production capabilities. From the point of view of achieving agreed standardization, licensed production with competitors is the principal problem to be solved.

Licensed production generally will involve increased production costs although the life cycle and support costs may be less because of interoperability and standardization. European labor productivity is not as high as US, partly because of European social welfare concerns,

including stability of employment. Economy of scale would be greater with a single production source, but such a source has its disadvantages, including vulnerability.

Licensed production that encourages production on both sides of the Atlantic encourages technology flow as well as standardization. There are several key opportunities for licensed production deriving from relative European and US industrial and technological capabilities. The tactical missile field is a good example of this.

ADVANTAGES AND DISADVANTAGES OF LICENSING

Licensed production can offer substantial advantages and can present substantial problem areas for NATO member countries and for the Alliance as a whole. These are listed in this section from the perspective of US participation, both as licensee and as licensor.

Advantages--US as Licensee

The following are potential advantages or desirable characteristics of the licensed production in the US of foreign-developed equipment:

- It can contribute to the US objectives of interoperability and standardization in NATO, extending to maintenance and other logistic support activities.
- It can reduce R&D costs by avoiding duplication.
- It can help diversify the US production base.
- It can provide a highly effective means of transferring valuable technology to the United States.
- It may permit more rapid US deployment of an important weapons system (instead of waiting for US development).
- It can provide jobs in the US.
- It can lessen US domestic pressures against buying abroad.
- It is less costly in balance of payments terms than buying a foreign manufacturing product.
- It can reduce Alliance vulnerability by diversification of production sources.
- It can fill US gaps in research and development by exploiting foreign scientific talent and technical expertise.
- It can help level out violent swings in defense production.
- It may expand the total US employment base, by permitting production to be undertaken sooner, rather than awaiting US development, and by permitting the resources that

would have been required for unilateral development to be applied to other development or production projects.

Disadvantages--US as Licensee

The following are potential disadvantages, undesirable characteristics or problem areas associated with the licensed production in the US of foreign developed equipment:

- Payments of license fees and/or royalties can adversely affect the US balance of payments.
- The production run in the US may be too short to justify setting up a US production line.
- Some element of US industry may lose a chance to produce an alternate system.
- It may mean giving up weapon characteristics desirable for US non-NATO purposes.
- It may encounter US military resistance to using foreign equipment.
- It could mean giving up the national option of developing and producing future generations of the equipment.
- It could make the US vulnerable to "supplier control" of parts or subcomponents.
- It may require difficult, time-consuming and in some instances costly steps to deal with US-European differences in such areas as language, measurement systems, safety standards, materials standards, testing standards, quality control procedures, tax laws, export controls, and security of information regulations. (These "conversion costs" must be deducted from R&D savings in arriving at a net judgment as to economic advantages and disadvantages.)

Advantages--US as Licensor

The following are potential advantages or desirable characteristics, from the US viewpoint, of licensing for production abroad of equipment designed in the US:

- It can contribute to the US objectives of interoperability and standardization in NATO, extending to maintenance and other logistic support activities.
- It can enable an Allied country to improve its contribution to the Alliance by expanding its technical and military support capability.

- It provides a highly effective means of technology transfer.
- It may be the only way to promote sales.
- It involves fees and/or royalties that favorably affect the US balance of payments.
- It can help make standardization more palatable to American industry.
- It can reduce Alliance vulnerability by diversification of production sources.
- It can tend to establish a trans-Atlantic working relationship that may encourage further collaboration and reciprocal trade in parts or sub-components.

Disadvantages--US as Licensor

The following are potential disadvantages, undesirable characteristics or problem areas, from a US viewpoint, of licensing for production abroad of equipment designed in the US:

- It may create a future competitor for the US producer.
- It is likely to complicate third country sales problems.
- It could lead to future undesirable transfer of technology.
- It may tend to weaken the production base in the US.
- There may be difficulties in selecting the most effective foreign licensee (foreign governments may intervene).
- It may involve, in the reverse direction, steps to deal with the kinds of US-European differences described above.

Appraisal

This examination of pros and cons suggests that licensed production, undertaken to promote interoperability and standardization in NATO, has a number of positive aspects from the perspective of US national interest. These include its contributions to NATO military effectiveness, economic health and political cohesion, in which the United States has a vital interest. They may also include specific contributions to the technological progress and economic welfare of the United States.

But licensed production is by no means a simple arrangement, and its advantages are not achievable without some significant and partially offsetting liabilities. Licensing generally involves higher

initial unit costs, it may reduce US freedom of action to some degree; and it will in any event involve complex efforts to deal with differences in industrial structures, differences in patterns of governmental involvement and other procedural or institutional problems. Efforts to facilitate licensed production by harmonizing different national technical and legal patterns should prove well worth undertaking.

PROBLEM AREAS FOR THE US LICENSEE (EUROPEAN LICENSOR)

US Government Foreign Military Sales Program

The European developer is very concerned about generating a competitor with his own product in his usual markets. He does not want to permit sales by his US licensee to these markets either directly or indirectly. There is not usually a question regarding direct sales, but indirect sales through the US Government is often an issue. The US licensee is reluctant to try to restrict the US Government as to what is done with the product after purchase. The European licensor wishes to restrict the US Government either through license clauses that do this directly or that call for foreign sales to be subject to government-to-government agreement.

Patent Infringement

The European licensor does not wish to have any liability arising from infringement of patents owned by third parties nor any obligation to bring any action for infringement of any of his patents. The US licensee primarily wishes to protect both himself and the US Government against claims of infringement. A frequent compromise is agreement by the licensor to provide information and technical testimony as requested but at the expense of the US licensee.

Compensation to Licensor

The European licensor does not want his compensation that he negotiated with the US licensee to be subject to US Government decisions on allowability. This includes both royalties and front-end payments, which may be for transfer of data packages or other efforts. The US licensee does not want to be obligated to pay monies for which he may not be able to obtain reimbursement from the US Government. The common

outcome is found by agreeing on compensation that both parties believe to be reasonable with the knowledge that the US licensee can always reopen the question with licensor if the US Government is adamant during contract negotiations. If some solution cannot be found during the reopened discussions, the US licensee can always refuse to enter into the contract with the US Government.

Cross License

The European licensor wants to have unrestricted rights to any changes or improvements made to his product by the US licensee. The US licensee is barred from agreeing to this by the International Traffic in Arms Regulations, which require US Government approval of such transfers. At the same time, the licensor routinely agrees to provide all changes and improvements that he makes to the product. This imbalance is particularly galling to the European developer and somehow ought to be corrected.

Sublicense to US Government

The European licensor wants the sublicense to the US Government to be on the same terms as the primary license. The US licensee is without means to determine if those sublicense terms will be acceptable to the US Government. If the terms turn out to be unacceptable to the US Government, the whole relationship is in limbo.

OTHER PROBLEM AREAS

Long-Term Implications of Licensing

As this study has shown, licensed production of weapon systems among NATO partners before the mid 1970s has been pursued mostly for purposes only indirectly related to NATO standardization. The major exceptions lie in the second pattern described in Chapter 3 when, for a period, the US actively promoted licensed production in Europe of US designed weapon systems for the dual purpose of achieving standardization (on US designs) and of transferring US technology to Europe to rebuild the industrial capacity of the European NATO allies. By the success of the programs in that pattern, short-term standardization was achieved in key areas and European industry was stimulated by the technology (both design and manufacturing) transferred. However, the changed (and desired)

technological/industrial balance between Europe and North America that resulted eventually became a principal factor in the present destandardization. To become an effective instrument of future NATO standardization, licensed production of weapons systems cannot be perceived by either the US or the Europeans to be re-standardization on US designs. Besides the specific problem areas and obstacles to negotiating European licenses to US firms noted in the previous section, several other hurdles may have to be overcome in the present circumstances.

One such hurdle, which could be examined only cursorily in the present study, may derive from the procurement philosophies of the three US Military Services. Over the years, each Service has developed a relation to the US industrial sectors that have supplied most of their weapons and equipment that is almost symbiotic. On the whole this is probably a normal and healthy relationship - not without its own pitfalls and potential abuses as critics of a "military-industrial complex" are ready to point out. The Services have benefitted from - and, perhaps more importantly perceive their role in national security to have benefitted from - the understanding, responsiveness, and confidence that has been built up with US industry over the years. To what extent this contributes to a "built-in" resistance to non-US equipment is worth attention. Can it be demonstrated to the Services that, in the national interest, they have much to gain by more licensed production of European-designed weapons systems?

Procurement philosophies of European services doubtless contain their own hurdles also as these services have developed similar relations to European industrial sectors. National procurement procedures and regulations as well as practices with respect to quality control, materials and production standards, safety standards, and security of information all reflect and - insofar as they differ from nation to nation - tend to perpetuate preferences or prejudices favoring one's own national designs. If licensed production is to become a militarily more acceptable as well as administratively convenient device for achieving standardization, it will depend on continued and even intensified efforts to bring procurement

procedures and regulations into greater harmony throughout NATO. Other national and international (e.g. European Economic Community) differences or barriers - taxes, tariffs, export and import controls, regulatory mechanisms, audit procedures, etc. - deriving from general industrial, commercial, and political interests also present some obstacles that tend to hamper licensed production and require harmonization.

Current US Directives and Guidelines

DoD Directive 2000.9 on international co-production is dated 23 January 1974 and thus precedes the moves by Secretary of Defense Schlesinger, President Ford, and the Congress to make standardization a reality and waive the impediments such as the "Buy American" and the specialty metal laws. Directive 2000.9 could now be revised so as to put more emphasis on the implementation of NATO standardization rather than on the impeding hurdles. Also there is a need for a Directive or other DoD publication that covers the case of a US company as a licensee of NATO countries or industries.

The companion publication by the State Department, "US Government Guidelines and Procedures for Reviewing Proposals for Co-Production Overseas of Defense Articles of US Origin," is more recent (Oct 1975) but specific guidelines for NATO co-production/standardization were regarded as beyond the scope of the publication. A publication that deals primarily with NATO cases would be very valuable. At least the more general guidelines publications should be brought up to date in line with Presidential and Congressional encouragement for licensing and co-production agreements among NATO signatories.

DoD Directive 2015.4 "Mutual Weapons Development Data Exchange Program and Defense Development Exchange Program," 5 Nov 1963, needs also to be brought up to date. This should be made relevant to the co-production case where the United States is not the licensor.

DoD Directive 2140.2, 15 March 1967, which calls for the inclusion of surcharges for nonrecurring costs associated with R&D, needs to be reexamined and the foreign contentions evaluated again. Foreign purchasers regard R&D cost as a legitimate cost to the US for its own national

defense. There are already many cases of surcharge waivers. There are NATO standardization interests and legitimate European concerns with such costs when the Europeans have also funded R&D and could say that they would be "paying double for R&D."

CONCLUSIONS AND RECOMMENDATIONS

Licensed production is a primary and workable mechanism for increasing interoperability or standardization. Licensing is a compromise between selection based on national protectionism and a common selection by a supranational NATO procurement agency. Such a NATO agency is not really feasible, and both US and European industry would rather have selection without licensing. Moreover, licensing does have problems that require real effort to solve. However, these problems generally are solvable. In experience to date, licensing has been in the production stage, frequently late in this stage, and this causes adaptation problems. A second problem is that of extra-NATO sales to third nations. A third problem is the problem of security.

The adaptation problem in transferring complex technology from one national environment to another may be due to differences in language, measurement systems, industrial structures and practices, differences in national laws, or differences in national interests. Practical approaches are needed to alleviate such frictions and differences at the intergovernmental level rather than pushing it down to the industrial level.

If the US is to press for standardization through licensed production, the problem of third nation sales must also be approached with consideration for the dependence of European industry on such sales, particularly in the cases of France and Britain. Intergovernment as well as interindustry negotiation is required in this area.

Communist membership in some of the trade unions that sit in on European management meetings constitute a military security problem within NATO. US representatives sent to negotiate licensed production are well briefed on this security aspect and frequently are so fearful of saying too much that they appear uncooperative and silent.

The problem of security has two aspects. One aspect concerns military or national security; the other the protection of industrial property and secrecy. In any licensed production arrangement, technology is inevitably transferred and control of its dispersion is lost to some degree. This is true in military sales as well, but there production know-how is not necessarily transferred along with equipment and its implicit technical data. The desire to protect national security data almost inevitably gets compounded by the inclination to protect trade secrets from potential competitors. Licensees are frequently unable to distinguish legitimate national security concerns from industrial competitive concerns of licensors, especially when a US firm is the licensor. This is an area requiring high priority attention.

A commitment before development or in early development to a common selection that would result in licensed production would, in many cases, enhance the prospects for the successful use of licensed production as an interoperability or standardization tool. Such an early commitment would avoid many of the problems that result when licensed production is introduced only after a successful national development. This means that countries must be willing to pay for development programs that do not lead to production. In return, through maintaining competitive development there is an opportunity to select from among better prototypes.

One approach to common selection from competitive developments is through colloborative funding. This approach is especially applicable when technologically advanced systems are involved. In the case of a very large complex system such as an MRCA, a F-16, or a tank, there may not be a common selection of the whole system but rather of key components such as the engine, airframe, or armament. However, such component selection does lead to the desired interoperability, and full standardization in such cases may be less desirable because of significant variations in military missions as well as differing national priorities, economic concerns, and national pride. Italy does not need the same MRCA as Germany or Britain, and the US may need a somewhat different tank than Germany does. In such cases licensed production would be of the key components.

NATO countries in Europe have recognized that licensing tends to be concentrated on systems that are in development or early production. European industry has preferred to emphasize the need to reach beyond the competing systems of the current generation and establish shared co-development programs for the next generations in each of the tactical weapons categories. Such an approach includes licensing within this co-development context.

The current European industrial concept calls for initial agreement on joint specifications, followed by collaborative R&D and, ultimately, a production program that typically involves two or more final assembly lines supported by a specialized division of labor and cross-vending of assemblies and components. Licensing has an important role in this process, especially in cases where existing major subsystems and assemblies (e.g., engines, avionics, and homing heads) can be incorporated in a new system.

Also of great importance is the European evolution of ad hoc intergovernmental organizations to coordinate government oversight of the resulting industrial consortia. Experience to date in the licensing of ROLAND II to the United States demonstrates the need for the establishment of intergovernmental authorities to resolve technical issues and establish industrial product and manufacturing specifications and standards, contracting procedures, and security regulations in advance of major licenses or other collaborative projects.

There is no uniform approach to licensed production that applies to all kinds of systems. One distinguishing feature is the degree of maturity of the technology. In such a case as the MAG-58, licensed production is an easy matter but it is not so easy for a sophisticated avionic system. The existing industrial capacity should also be taken into account.

The common problem areas for the US licensee of a European licensor are primarily concerned with the role of the US Government. The US Government is an uncertain factor that generally enters late in the negotiations. The European licensor is concerned about generating a

competitor with his own product, with liability arising out of infringement of patents, with the US Government making later decisions on allowability of his compensation, with maintaining unrestricted rights to changes or improvements, and with the terms of a sublicense to the US Government.

There is a need for high level offices in every NATO MOD (including the US DOD) to serve as clearing houses on all technical matters pertaining to NATO standardization and interoperability as they affect national procurement decisions. At present there are no offices within NATO MODs that are charged with the responsibility of ensuring or certifying that weapons being funded for R&D or for production and acquisition meet requirements for NATO standardization and interoperability or that no alternative programs or systems exist within NATO that could be candidates for collaborative funding, co-development, or licensed production. Collaborative funding, co-development, and licensed production tend to be treated in the acquisition process on an exceptional basis and advocated only when other circumstances - e.g. inadequate R&D budget, limited technological capacity in a particular area, urgent military requirement - demand. Even licensing one's own national designs for production in another NATO country tends to be treated in the bureaucratic process as a concession to a vague policy, to US industry seeking markets, or to European countries seeking offsets. If standardization efforts, including licensed production policies, are to be given force, much stronger technical guidance and certification that such guidance is followed needs to be provided in all aspects of the weapons acquisition process.

Licensing policy could be developed and proposed for a variety of systems. Currently the principal responsibility for licensing within the US Government resides in the Munitions Control Office. Clearance and approval for licenses is under Munitions Control. However, an office is also needed that is an advocate of licensing rather than a "nay-saying" office. The Air Force F-16 SPO is an example of an office that is successfully making licensed production work. However, this is an after-the-fact

device in this case. An analogy in the MRCA case is Panavia and the NATO management system that is dedicated to making the MRCA system a success. Licensed production needs high level offices to seek opportunities for licensing and to make them work.

There is a question as to whether there are appropriate licensing authorities as well as policies. Where should the efforts be made to seek opportunities to license and to make license arrangements work? Licensing should be thought of as a positive policy.

There should be a move away from government surcharges for R&D. Surcharges should be used principally for licensed production in countries that have not done any R&D. In instances such as the F-16 they are appropriate but should be kept low. The original motivation for such surcharges was the US balance of payments problem but conditions have changed from this earlier period. In countries like France, Germany, and Britain where significant R&D money is spent the surcharge should be very low, if not zero.

Licensed production should emphasize competition among good industrial capabilities, and there should be licensed production of losing competitors and the use of superior features developed by the losing competitor. Licensed production should be a device for achieving as much commonality and selection as possible among competent industries and technologies. Licensed production can be used as in the F-16 case to achieve sales among countries who have low development capability or it can be used as a device to achieve a better selection among countries that have high development capabilities. The latter holds greater promise for interoperability or standardization.

Losing competitors can undertake licensed production of components, and some features of their prototypes may be used. This would mean that there are really no completely losing losers or completely winning winners. This keeps technology alive and well, and companies that lose do not lose everything. They will be licensees for someone else's design. This will affect their pride but keep company and R&D capability alive. The next time around one of the current losers may win.

The government could buy a foreign license and determine later who gets a production contract. This would be an alternative to the way the XM-1 was handled. The advantage of this is that the losing competitor can easily be awarded some licensed production. The disadvantage is that the foreign competitor would not have a strong representative pleading his case. It may, nonetheless, be well to have the government buy the license in cases of a US prototype versus a European prototype. If two international cross-Atlantic consortia are involved then presumably licenses would be prearranged. Government purchase of a license encourages a dumbbell (US-Europe) approach which has many advantages. There are other advantages, however, in consortia competitions which incorporate industrial internationalism. There is no single pattern for all industries. For the MAG-58 case the dumbbell approach is much better.

Licensed production can be used as a device for facilitating later collaborative development. Companies may develop different parts, and the production of the components may be distributed under licensing arrangements. Feedback and product improvement may well be involved, leading to future collaborative development and licensed production, and the production of succeeding models can be coordinated. Collaboration in the development of civilian aircraft would establish a basis for greater collaboration and standardization in military aircraft.

DoD regulations should be prepared for the case of a US company as a licensee. Present regulations cover the US as a licensor and this is the old one-way street case. There are feedback and other situations in which such regulations would be useful.

The US/British Memorandum of Understanding, as originally intended according to the Memorandum, should be extended to NATO with emphasis on licensing.

A NATO licensing working group or the NATO MOD technical office proposed on p. 7-13 should be given the job of codifying the present laws and regulations regarding licensing, recommending simplification of the mechanics as well as the laws and regulations, and reduction of the impediments, so as to make licensing easier among NATO countries.

A promising device that could also lead to other forms of achieving NATO standardization and interoperability, licensed production still has substantial hurdles to overcome. Some immediate steps that could be taken to facilitate greater use of licensing on a two-way basis include:

- Harmonize and simplify, if possible, US national procurement policies and procedures of the three Military Services with respect to acquiring European weapons under licensed production arrangements.
- Encourage harmonization and "standardization" among NATO countries of procedures and steps in the weapons acquisition process, including bidding methods and forms, test and evaluation, selection criteria.
- Identify existing political and commercial barriers - e.g. taxes, tariffs, export controls, accounting procedures, allowable costs, production standards, security regulations, etc. - that tend to hamper licensed production and might be reduced.
- Revise DOD Directive 2000.9 (23 January 1974) on international co-production to put emphasis on NATO standardization.
- Revise the State Department publication (October 1975) on US Government guidelines and procedures for reviewing proposals for co-production to include and emphasize NATO standardization.
- Revise DOD Directive 2015.4 (5 November 1963) on mutual weapons development data exchange to account for the current emphasis on NATO standardization and to include the case when a US firm is the licensee.
- Revise DOD Directive 2140.2 (15 March 1967) on surcharges for nonrecurring costs associated with R&D to account for and accommodate NATO standardization interests and legitimate European concern with such costs when they have also funded R&D.

Appendix A
US EXPERIENCE IN LICENSING WITHIN NATO

INTRODUCTION

The principal aim of this appendix is to encompass and collate the significant features of a representative sample of international licensing arrangements for production or co-production of military equipments that have been undertaken by two or more NATO partners over the past twenty years. Special attention in this review is given to identifying problems encountered in past and present licensing cases and any benefits that may have been realized.

The general background of licensing, both as a governmental and as an industrial instrument for effecting national policy, is first explored and then specific cases are reviewed in order to identify the factors that may be encountered in weighing future licensing options.

Pertinent government regulations relating to disclosures of defense information and to certain legal constraints on international data flow as practiced by NATO nations are identified and discussed briefly. Each of these, when coupled with the hazards to security resulting from co-production, has an ultimate bearing on the implementation of international licensing.

The factors that appear to have the most effect on the efficiency and operational effectiveness of international management organizations are identified and assessed.

The appendix concludes with a listing of issue-oriented observations that government authorities will need to take into account in weighing future licensing options.

LICENSING AS AN INSTRUMENT OF FOREIGN POLICY

The use of licensing arrangements to effect US foreign policy is not new. Some licensing of European production of ammunition and communications equipment was initiated during the early 1950's, although the Military Assistance Program was the primary tool used to replenish the Allies' war-depleted inventories through out-right grants-in-aid of military equipments. The Technical Assistance and Mutual Weapons Development Programs were also used to start the rebuild of European R&D capabilities.

By the mid-1950's, however, the United States had become concerned that the rate of technological development in Europe was not moving at a sufficiently rapid pace for Europe to provide itself with a level of conventional modern weapons production capability that the US considered desirable in the decade of the 60's. This concern was prompted by the Soviets' growing nuclear capability which caused the US to begin having second thoughts about the viability of its basic rationale for overall defense, namely, massive retaliation. Accordingly, the US set out to find answers to these concerns in the face of a rising awareness that most of its NATO partners were approaching an economic recovery point where an end to free military hardware hand-outs was in sight. While the US held to the view that partnership in NATO meant that Europe must be able to do more for itself if it were to do more for NATO, the question was how to assure this.

In December 1956, Secretary of Defense Wilson announced to his colleagues at the NATO Ministerial Meeting in Paris that the United States planned to make available information which would enable a number of modern weapons to be developed and produced in Europe. The practical effect of this policy pronouncement was the series of NATO projects that resulted in the licensed production of American designed HAWK, SIDEWINDER, F-104G, BULLPUP, Mark 44 Torpedo, and M-72 LAW systems in Europe during the 1960's. The use of licensing arrangements thus became the instrument for effecting a US foreign policy decision to facilitate the recovery rate of Europe's armaments industries.

However, the rash of NATO projects designed to speed up Europe's ability to support and sustain itself militarily ended almost as quickly as it began. Balance of payment (BOP) problems, which started to plague the US in the early 1960's, forced a reversal of policy from placing emphasis on licensing US weapons for production in Europe to one of campaigning for sales to Europe of weapons made in the United States. Hence domestic political and economic considerations ultimately prevailed over the rationale that originally led the US to decide to transfer its production know-how and weapons technology to Europe.

In retrospect, weapons projects that have resulted from the US teaming up with two, three, four, or more nations to build a common item of equipment have become the exception rather than the rule. As case histories, they are less likely to be studied as examples of dedication to the principles of weapons standardization in NATO than to be remembered as expressions of national self-interest. In a similar vein, those examples of cooperation initiated among the European partners of the Alliance have resulted by and large from case by case decisions hammered out in the shadow of mutual economic necessity to preserve and protect the viability of some segment of their own newly developed defense industries.

In short, history demonstrates that although the NATO partners have consistently avowed their adherence to the underlying principles of standardization through cooperation in research, development and production of military equipment for Alliance forces, progress toward that goal has seldom, if ever, resulted from "natural" causes within the North Atlantic Council itself or NATO's multilayered committee substructure (Ref. 1). When there were not clear-cut economic or technological imbalances to redress, government-to-government decisions to co-produce an item of equipment or to license production among two or more NATO partners have depended on mustering sufficient political willpower to overcome the institutional pressures against exporting defense technology or importing "foreign" weapons.

LICENSING AS AN INSTRUMENT OF NATIONAL ECONOMIC POLICY

As previously noted, such governmental cooperation as there has been in research, development and production of military equipment

over the past twenty years has owed as much or more to national political and economic influences as to military needs. While this has made the quest for NATO standardization more difficult, it is perhaps not unnatural considering the fact that nations tend to treat national defense matters with the same care and devotion they usually accord their own sovereignty. One of the basic characteristics of weapons producing industries is the protection they receive from their host governments. The institutional customers for weapons have been governments themselves, and these, for the most part, have been wary in their dealings with foreign producers. As a result, the post-World War II era has witnessed the development of extensive national defense industrial assets, protection of which by host governments is still considered essential to their continued existence. The development and protection of these national industries is what is responsible today for the progressive de-standardization of NATO armaments, the suppression of international competition which tends to produce efficient industries, and the fragmentation and overlapping of technological efforts world-wide (Ref. 2).

In effect, it has not been customary for defense industries to "go" international, to grow, and to extend their product lines abroad in the sense of an IBM or a Shell. This contrasts sharply with the situation in non-defense industries where international cooperation is hampered by few such constraints. License arrangements, technical and financial links, and joint ventures among European firms and between European and American firms on non-defense matters are common. Such links usually result from the normal process of business growth and pursuit of markets. Even in times of political tension, economic stress and war, the existence of international commercial linkages provides a measure of safety and some assurance that at least part of the union may survive. Viewed in the context of this study, however, the difficulty with such links is that they do not by themselves ensure that there is a common market in defense production and, at least to date, they have not been given a free hand in helping governments develop the new approaches to arms cooperation that seem to be most needed.

Notwithstanding the obstacles, history may at last be turning the page. During the past several years the economics of weapons production

has wrought a gradual change in national weapons-marketing attitudes, particularly in the three larger European industrial nations - France, Germany and the United Kingdom. There the combination of high technology costs, small production runs, and constrained military budgets have made the production of modern weapons systems difficult to justify economically in the absence of having an international partner with whom to share project costs or additional countries as markets. The result has been to put both government and industry into the business of looking for allied collaborators and foreign customers.

Under the umbrella of mutual economic interests, these pressures have already resulted in several European defense projects "going" international (e.g. - MRCA, F-4 (British version), JAGUAR, MARTEL, ROLAND I, A-330, A-340 and WG-13 Helicopters, FH-70 and SP-70 155 mm How.) In recent testimony before the Congress, Mr. Phillip Goodhart of the United Kingdom observed:

> There can be absolutely no doubt at all that in the present climate there will be very substantial criticism of any defense ministers in Western Europe who make, say, substantial purchase(s) of foreign equipments without obtaining important, offsetting offers (Ref. 3, p. 15).

During the same Senate committee hearings, General Josef Van Elsen of the Netherlands summed up the situation in these words:

> The failure to rationalize our defense resources has meant that we have always looked to outside markets, particularly in the underdeveloped and developing countries, to recover our investments. In this sense, we have contributed in a major way to the wasteful and potent potentially dangerous escalation in the present expenditure on armaments in the world today (Ref. 3, p. 17).

Slowly the Western Powers have come to realize that NATO cannot have 13 types of anti-tank weapons, 25 types of warplanes, and 15 types of tanks and still expect the industries producing them to survive. While lack of defense funds with which to make further significant increases in capital expenditures is already recognized, the yet unresolved problem is the waste of existing resources stemming from the duplication in virtually all categories of existing effort, particularly R&D and procurement.

Industrial licensing offers a method of co-producing a number of weapons sytems in each of several participating nations, thereby enabling each to share in at least a part of the action. Technology thereby becomes shared, jobs are assured, and R&D costs are distributed more equitably. The importance of industry as an adjunct of national economic policy in the defense arena thus assumes a new dimension. In light of history, however, the questions yet to be answered are how well the armaments industry may be equipped to assume an international role, and how well governments may be prepared to support it in the effort.

POLICY, LAW AND REGULATIONS

Government Licensing Policy

Most NATO governments have a fairly extensive range of measures for exercising control over the export of industrial property or the rights therein with a bearing on defense. These measures include: (a) the placing of secrecy on inventions having a bearing on defense, (b) the requirement to report to the government concerned any information likely to be of importance for defense, (c) the ban on the export of equipments, and (d) the bar on the disclosure of information relating to defense.

Some countries have detailed regulations covering the export of arms, ammunition and military equipment and the industrial property rights and technical data pertaining thereto. In Belgium, for example, the provisions of the Law of 10 January 1955 on the disclosure and exploitation of inventions and trade secrets affecting the national defense and state security may apply to the export of property rights where appropriate. A system of export licensing has been introduced for armaments, ammunition and military equipment or equipment that could be used for military purposes. This system is at present based on the law of 11 September 1962, on the import, export and transit of goods (Ref. 4).

In France, the decree/law of 18 April 1939, which lays down the requirements governing military equipment, weapons and ammunition, specifies that commercial manufacturing licenses and any document required for the manufacture of such items cannot be assigned without approval of an interdepartmental committee. In Germany, the terms of the foreign

trade law (Aussenwirtschaftsgesetz) require that an export license be obtained for industrial armaments, ammunition and defense equipment where such items involve state security, peaceful co-existence between people and the Federal German Republic's external relations (Ref. 4).

In the United States, the International Traffic in Arms Regulations drawn up by the Department of State (Ref. 5) under authority of the Mutual Security Act of 1954 (Ref. 6) stipulates that agreements between persons and companies in the US and foreign persons or entities, and relating to licenses for the manufacture abroad of items on the Munitions List or the furnishing of technical assistance in respect to those items, must be submitted to the State Department before the effective date of the agreement and must be authorized by the Department.

US Law and Procedure

Section 414, Mutual Security Act of 1954, provides as follows:

> a. The President is authorized to control in furtherance of world peace and security and foreign policy of the United States, the export and import of arms, ammunition and implements of war, including technical data relating thereto, other than by a United States Government agency. The President is authorized to designate those articles which shall be considered as arms, ammunition, and implements of war, including technical data relating thereto, for the purpose of this section.
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> b. As prescribed in regulations issued under this section, every person who engages in the business of manufacturing, exporting, or importing arms, ammunition, or implements of war, including technical data relating thereto, designated by the President under subsection (a) of this section shall register with the United States Government agency charged with the administration of the section, and, in addition, shall pay a registration fee which shall be prescribed by regulation. . . (Ref. 6).

Section 101, Executive Order 10973, provides that, by virtue of the Foreign Assistance Act of 1961 (75 Stat. 424) and section 301 of Title 3 of the United States Code and exclusive of the functions otherwise delegated or reserved to the President, by provisions of this order, the Secretary of State is delegated all functions conferred on the President by the unrepealed provisions of the Mutual Security Act of 1954.

Executive Order 11432 amended Executive Order 10973 to provide that so much of those functions conferred on the President by section 414 of the Mutual Security Act of 1954, as amended, as relate to control of the import of arms, ammunition and implements of war, including technical data relating thereto, are delegated to the Secretary of the Treasury.

In due course, the Department of State promulgated an "Enumeration of Articles" under Title 22, part 121, Code of Federal Regulations, designated as "Arms, Ammunition and Implements of War", and known as the "US Munitions List". Persons engaged in the business, in the United States, of manufacturing or exporting articles enumerated in the List are required to register with the Secretary of State. Conversely, those engaged in importing such articles must register with the Secretary of the Treasury. Exceptions apply to persons whose pertinent business activities are confined to the production or exportation of unclassified technical data relating to arms, ammunition and implements of war, or whose export activity is subject to license under the provisions of the Atomic Energy Act of 1954, as amended, and does not include export of articles on the US Munitions List.

In order for any person to export equipment on the US Munitions List, or technical data, either classified or unclassified, that can be used, or be adapted for use, in the design, production, manufacture, repair, overhaul, etc. of arms, ammunition and implements of war on the Munitions List, he must first obtain a license from the Department of State unless otherwise exempt under the provisions of part 123.

Proposed agreements and proposed amendments to existing agreements between persons in the United States and persons in foreign countries, private or governmental, for (a) the manufacture abroad, whereby an American person grants a foreign person a legal right or license to manufacture abroad, or (b) the furnishing abroad of technical assistance, such as the performance of functions and/or the conveyance of information involving the disclosure of technical data, as opposed to granting a right or license to manufacture, relating to arms, ammunition and implements of war on the US Munitions List, must be submitted in writing to the Office of Munitions Control, Department of State, for approval from

the standpoint of world peace, United States foreign policy, and the security of the United States. The proposed agreements must contain, inter alia, all the information and statements in terms as precise as possible as prescribed in part 124.10, Title 22, CFR.

In essence, these provisions concern the:

a. Equipment and technology involved.

b. Duration of the proposed agreement.

c. Detailed description of the assistance and information to be furnished and manufacturing rights to be granted.

d. Delineation of areas into which the licensed articles and/or data is authorized and not authorized for transfer, and

e. Clauses of a legal and financial nature.

The above mentioned regulations are in addition to other controls exercised, if appropriate, by the Departments of Commerce and Treasury. The Department of Commerce is authorized by the Export Administration Act of 1969 to prohibit or curtail the exportation of any articles, materials or supplies, including technical data, to the extent necessary to further the foreign policy of the United States. An appropriate license must be issued in order to export such material. The authority of the Treasury Department's control is provided in the Trading with the Enemy Act, whereby all transactions between US companies or firms and certain countries in the Communist Bloc are prohibited without a Treasury license.

Commercial Licensing

As we have seen from the foregoing outline of relevant regulations, government licensing is an essential element of national security policy and must be taken into account in evolving whatever method is chosen to achieve standardization in NATO. Commercial licensing is also a tool used by business establishments for effecting commercial transfers of data and/or end items either within or across international borders for the purpose of manufacturing, modifying or adapting the design thereof for the use of second or third parties. The technique of drawing up licenses is well known to those familiar with the trade. In general, licenses include provisions, as the case may be, for such matters as: government and industrial property rights; (proprietary data, trademarks,

inventions, etc.); security controls; transfers of industrial know-how; technical assistance and advice; warranties; industrial drawings, specifications, manufacturing standards, etc.; quality controls; project management; changes, improvements and deviations; third party sales; fees; matters beyond control (force majeure); patent infringements; consequential damage; applicable laws; authoritative texts; taxes and imports; and settlements of disputes. What is important about licensing, however, is not so much the content of the license per se but how the work that results from it is carried out.

REPRESENTATIVE SAMPLE OF LICENSING ARRANGEMENTS

Foreign Designed Weapons Produced in the United States

Over the years the US Military Departments have occasionally purchased foreign hardware as well as engaged in production in the United States of foreign developed equipment. Experience ranges from simple guns to complex missile systems. The compilation of a sample listing of systems and equipments that have been acquired by the US from foreign developers in recent years makes it obvious that few such programs have been initiated specifically in response to a stated need to acquire and utilize foreign technology per se. Rather, the root cause has usually been a need to satisfy a military requirement for an operational piece of hardware in less time than the normal R&D cycle would allow. In such cases the time factor was deemed to be of sufficient importance to override recourse to normal procedure. Before the advent of the new State/Defense standardization policy (Ref. 7) and the pervasive influence of the "sense of the Congress" expressed in the Defense Appropriation Authorization Acts of 1975, '76 and '77 (Ref. 8), as amended, the only persuasive justification considered likely to be able to override the constraints of the Buy American Act (Ref. 9) and the regulations concerning Balance of Payments (Gold flow) (Ref. 10) were the exigencies of war.

In this review several examples, some as much as ten years apart, have cast considerable light on early US experience in licensing US production of foreign weapons, especially the manufacturing problems involved.

B-57 Aircraft (CANBERRA). During the Korean hostilities in 1951, the USAF decided to procure two fully equipped CANBERRA aircraft as test vehicles and models for determining minimum engineering modifications necessary to obtain an American version from Hawker Siddeley, the British producer. The aircraft and a technical data package were duly obtained. The data produced immediate complications. It contained British third quadrant projections as opposed to first quadrant projections as is standard in the US. Drawing specifications were often seriously out of date, thus causing major problems in matching drawings to existing aircraft hardware and in ordering ancillary equipment. Auxiliary equipment ordered by using advertised specifications was often dissimilar to the actual hardware received. It must be remembered, of course, that at that time (a quarter century ago) configuration management and control techniques were far from what they are today.

Differences in terminology caused problems in understanding design intent and analysis. Tests indicated that design analysis had been very loose by American standards, and consequently basic tests and stress analyses had to be conducted as soon as a questionable item was identified. An entire analysis of the aircraft became necessary in order to ascertain adequate margins for design safety.

British designs were found to include subtle differences such as different milling thicknesses of metals, different bend-radii in metals, edge differences on rivets, and different countersinking requirements and techniques. The US has more stringent requirements for edge differences on fastener holes, stiffener spacing for sonic environment, design fitting factors, control system design factors, fatigue design, process tolerances, and single engine performance than the British. A major effort was required to select materials specifications that would have equal or better characteristics in all facets of ultimate yield, elongation, corrosion resistance, fatigue properties, and be within the constraints of variations of standard thickness gauges, bend-radii, heat treatments, and differences in physical property testing techniques. In short, the aircraft had to be redesigned.

More extensive personnel interchanges and liaison thus became necessary because of the differences in drawings, technical jargon, inspection techniques, and production philosophies. The contract required the Martin Company to subcontract sizeable portions of the work. At this time US industry did not possess adequate aircraft subcontracting capability, thus complicating the transfer of know-how. Complete new sets of drawings, analyses, handbooks, manuals and technical orders had to be created in order to make the aircraft "producible" and supportable within the US. On the other hand, provisioning for the aircraft and its engines, once they had been produced, never became a significant problem. By then the aircraft and its main features had been completely "Americanized". All that remained of the original CANBERRA was its silhouette (Ref. 11).

MK-87, MOD 0 Two Gun Fire Control System. During the early 1960's, the Navy settled on procurement of the Dutch WM/22 Gun Fire Control System in order to up-grade its existing gun fire control system. The WM/22, developed by Hollandse Signaalaparaten (HSA), was designed around a NATO specification, and many of the electronic components happened to have been procured in the United States. The Navy originally was going to buy the technical data package and eight units but later cancelled out in favor of buying only two complete gun units instead. Sperry Rand was given a cost-plus-fixed-fee contract in September 1964 to "Americanize" the two Dutch units into a system to be known as the MK-87, MOD 0 Gun Fire Control System.

The licensee set out to manufacture the MK-87 within the constraints of the original contract. The acquisition of data proved difficult primarily because of the methods employed by the Dutch in transferring the drawings. The material received from The Netherlands consisted of large bundles of drawings, some of which were old, out of date and in some cases not even related to the WM/22. Costly identification of applicable drawings was required. One million dollars was expended in updating the drawings and schematics, and $3 million was spent on translation. Throughout the process, Sperry made an additional effort to secure basic physical configurations by making photographic reproductions of the equipment and components to supplement the drawings.

Since the entire program involved the "Americanization" of only two systems, no large tooling effort was required. Sperry converted foreign designed parts to American equivalents, retaining overall envelope dimensions. The transfer of know-how was implemented by an exchange of management personnel and engineers. Resident engineers from HSA were present at Sperry, and Sperry's technical and management people maintained liaison representatives at HSA in Holland. Sperry also queried vendors to determine what dimensioning system was preferred. When a preference for the customary US units was expressed, Sperry converted to the US units and controlled the conversion by in-house computers in an attempt to reduce vendor interface errors.

The two systems fabricated to the Dutch design were subsequently subjected to "in-plant" tests, land based tests, system integration tests and finally technical evaluation. The tests authenticated producibility. After operational evaluations of both units were completed they were deployed to Vietnam, from which they were subsequently returned to the Long Beach Naval Shipyard in 1971 for modification to include Interim Surface-to-Surface Missile Capability (ISSMC). Although the "Americanization" program saved 12 to 18 months over the estimated time required to produce an all-US unit from scratch, it cost the Navy 41% more to go the Dutch route. The question that remains unanswered is whether it might have been possible to reproduce the Dutch units without first "Americanizing" them. The answer would appear to be "No" (Ref. 11).

AN/TPS - 58 Radar. In order to fulfill an immediate combat need in Vietnam, the Army initiated action through ENSURE procedures (Expedited Non-Standard Urgently Required Equipment) that resulted in the acquisition of 24 TPS-58 radar systems from France as well as the rights to produce them in the US.

The original family of radar developments, of which the TPS-58 was a member, initially began in 1963 as a cooperative program between France and Germany using US furnished Mutual Weapons Development funds. The development contractor was Laboratoire Central de Telecommunications (LCT) of France.

Just as in the previous cases, the military service concerned, the Army in this case, decided at the outset that in order to render the TPS System producible it would first have to be "Americanized." The Army Electronics Command (USAECOM) gave the job to ITT Gilfillan (ITTG) whose international parent organization, ITT, had existing licensing agreements with both the foreign developer and the domestic producer. The Army made the choice of ITTG deliberately in expectation of reducing data transfer problems. While problems still abounded, they would undoubtedly have been more severe had this particular arrangement not existed. Some of them are outlined below.

1. Although French and German Government proprietary data rights were included as part of the US purchase agreement, proprietary rights of the licensor were not. This is a characteristic legal wrinkle that is often encountered when one undertakes to acquire data rights from European governments for weapons developed by private industry at government expense. Generally, governments other than the US do not acquire and place their rights freely at the disposal of third parties, even within their own countries. When letting research and development contracts to industry, the FRG, for example, as a rule only reserves the right to use the resulting R&D work in question and allows the developer to retain property rights. When the object of the contract is reproduced by a third party for government account, the original contractor receives a reproduction fee for the "intellectual services" performed under the R&D contract (Ref. 4). In this case, the industrial property rights did not pass to the US along with the French and German Governments' title and interest in the TPS-58.

2. French drawings could not be used for US production due to deficiencies in symbols, specifications, terminology, drawing practices, standards, and materials.

3. Test data could not be procured from France. There apparently were none. Accordingly, early tests were conducted at Fort Sill, Oklahoma, in 1969, to appraise the system's potential.

4. ITTG converted the French drawings to its own use and for issuance to subcontractors where components were to be procured. Dual dimensioning (both in US and metric units) was used on some of the converted drawings. This later proved to be a mistake, creating problems with tolerance laps and errors due to choosing the wrong figures.

5. European tooling and manufacturing methods differ from those in the US, due in part to the quantities and rates of productions in European plants. Production systems, methods and standards also vary from country to country and from shop to shop. Each tends to specialize on a product or process.

6. Printed circuit boards are considered tooling in France and consequently the necessary data were not provided.

7. The US normally uses closer tolerances in production. In many instances, Europeans hand-fit parts, thus creating difficult conversion problems.

8. Since quality control standards were not in vogue at the time, either in France or Europe as a whole, ITTG had no accurate basis for measuring materiel acceptance. Lack of formal records precluded knowledge with respect to performance. ITTG therefore maintained a quality control representative in France for the life of the contract.

9. US safety standards are more stringent than in Europe. The US places great emphasis on the preservation of human life, and pressure groups and others have whetted Congressional interest to the point of assuring development of strict safety requirements.

10. Electronic components in the French design were found to be overstressed by US standards and had to be changed.

11. The US has more severe requirements for moisture proofing to satisfy world-wide deployments. Wider spectrums also exist for temperature, humidity, salt air, salt water, high altitude, velocity, shock and vibration than in most Western nations.

12. The generally poor design of European fasteners in respect to thread-to-shaft ratios dictated the substitution of US standards.

13. European power supply voltages vary from country to country and require that equipments be modified to accept US military standard power supplies.

14. Variations between European mill-rolled metal gauges and alloys, as compared to US standards, require re-engineering of European designs to US production standards.

15. The French, and most European countries, have a different concept of supply and maintenance for equipment support than does the US. French Forces simply return malfunctioning equipment to the manufacturer for all but minor repairs. Since little repair work is performed in the field, minimum amounts of spare parts are normally provisioned, thus creating problems for ITTG which had to supply spares for the US units deployed to South East Asia. "Floater" units were eventually deployed along with operational units and cannabalized as the need arose.

16. Because of the maintenance philosophy described above, field maintenance instruction and manuals were non-existent. These had to be developed. The same situation applied to training manuals, but for slightly different reasons. The French use long tenure enlisted men with accumulations of extensive on-the-job training for operations. The US uses accelerated technical training courses for shorter term personnel, thus necessitating differently designed training manuals.

17. Because obtaining data rights (par. 1, above) for some of the components was considered unreasonable, the Army decided to re-engineer certain of them rather than buy them from the French manufacturer. Other components were re-engineered simply in order to satisfy US production standards and vibration and life tests. Soldered connections were all changed from surface to flow-thru type. In many instances items purchased

to form, fit and function specifications (where the French retained the data rights) were found to have improved performance over their original counterparts and be more economical.

18. Foreign built test equipment had to be re-engineered or modified to incorporate US standard components such as meters, etc. (Ref. 11).

Perhaps one of the most significant facets of this procurement was the fact that since Laboratoire Central de Telecommunications (LCT) was an affiliate of ITTG, the transfer of this system received better coordination and cooperation than might otherwise have been the case. Negotiation of the US contract with ITTG negated the need for a license from LCT. Essentially all the AN/TPS-58 data were retained within the ITT international family. It would appear from this case that management arrangements of the type represented by ITT could help improve the use of international standards and international testing methods to be conducted during the original development of the items subsequently chosen for US production.

ROLAND II - Short Range Air Defense System. In 1974 the US evaluated four air defense systems proposals: the UK RAPIER, the French CROTALE, the US CHAPARRAL, and the French-German ROLAND II. The ROLAND was judged superior in meeting US Army requirements, and Hughes Aircraft Company was awarded a contract in January 1975 for technological transfer, fabrication and test "of a system based on the ROLAND II." The Memorandum of Understanding (MOU) between France, the FRG and the US states that the three countries will seek an optimum level of standardization and interoperability for their respective ROLAND systems. Secretary of Defense Rumsfeld reported to the Congress that "as a minimum, missile interchangeability (allowing each system to fire the others' missiles) will be achieved. Additional interchangeability will be accomplished wherever it makes operational and economic sense" (Ref. 12).

It is apparent from the Secretary's report to Congress that, as in the case of the previous systems, the ROLAND produced in the United States is not intended or expected to be an exact copy of the original. How much of this may be due to previous US experience in adapting European designed technical data to US specifications, how much may be due to changes that were foreseen because of the desire to incorporate

advanced US componentry, and how much may simply have resulted from the need to adapt the system to a US mount, need not be discussed here. The fact is that ROLAND II is undergoing "Americanization." It is of interest to note, nevertheless, that the license agreement contains language indicative of a US determination to obtain from the licensor the precise technical data necessary to manufacture the same missile, subject to modification, as is being produced by Euromissile. For example, a "Dossier de Definition Initiale (DO)" was appended to the agreement listing and defining the types of material intended to be transferred under the agreement. This transfer should include "at least":

1. Manufacturing drawings (assembly drawings, detail drawings, drawings of unfinished parts).
2. Interface drawings.
3. Diagrams.
4. The nomenclature (standard and indentured).
   - Standard nomenclature lists the parts with the quantities required for the manufacture of the equipment.
   - Indentured nomenclature gives the same indentification as the standard nomenclature, specifying the relationship of the part groups.
5. The numerical indices listing documents used for the manufacture of specific materials.
6. The acceptance specifications giving the particular characteristics to be measured such as permissible tolerances.
7. The procurement specifications for orders for standard commercial items if their utilization requires special specifications.
8. Technical notes concerning the manufacture and assembly operation established by the engineering department. It gives the principles and characteristics to be observed in order to assure correct manufacture assembly and inspection (Ref. 13).

Elsewhere in the license "Euromissile know-how" is defined as "information Euromissile, Aerospatiale, MBB and their sub-contractors have relating to licensed devices including technical data and engineering information, specifications data, cost data, tooling information, quality control procedures, and proprietary processes for the extent actually used by Euromissile, Aerospatiale, and MBB and their sub-contractors for the manufacture, testing, installation, service and repair of licensed devices" (Ref. 14).

Observations. The reputed American proclivity for tinkering is not the basic reason the United States "Americanizes" foreign weapons systems produced in this country under license. Europe, with the possible exception of the United Kingdom, has had less time and further to go in developing modern weapons and the production base from which to support them. European production systems vary depending upon the customs, traditions, labor practices, tool designs, and capital structures of the industries/nations concerned. Weapons designed and manufactured according to the production standards of any European country therefore entail some conversion to US production standards to be producible here as well as to meet US standards of reliability, safety, serviceability, etc.

Within the past few years, however, vast strides have been made by Europeans not only in developing weapons technology but in translating it into quality-tested products that more than meet the operational requirements of the particular country or service concerned. In light of the continual advances being made in European production standards caution should be exercised to assure against unnecessary "Americanization" of European designed weapons sytems produced in the US in the future.

US Designed Weapons Produced in Europe

The problems associated with licensing of US weapons in Europe are not greatly different from those encountered in European licensing in the US. However, the reasons for the problems are somewhat different.

While the basic content of licenses used to effect the transfer of proprietary data and production know-how from the United States to Europe is not markedly different from that used to transfer such data from Europe to the United States, the emphasis each side places on the importance of producing an exact copy of the prototype has varied 180 degrees between Europe and the US. The US has typically wanted the same weapons produced in Europe as in the United States. It wanted the European produced weapons to be completely compatible and interchangeable with US produced weapons in the hands of US troops deployed in Europe. The Europeans did not seem so concerned about US adherence to European configuration, undoubtedly because they knew they did not have the same negotiating leverage and that their systems would have to undergo

a certain amount of "Americanization" to be accepted.

M-113 Armored Personnel Carrier. A case in point is the M-113 Armored Personnel Carrier, manufactured in Italy for the Italian forces by Oto Melara under license from FMC Corporation. The license provides an excellent example of the type of provisions the US spelled out for technical assistance and services to be performed by the licensor. FMC was obliged to:

1. Establish and maintain a separate department to be formed within its Ordnance Division to handle all matters concerning the Agreement, it being understood that the costs of this department would be kept to the lowest practical amount.

2. Supply manufacturing drawings to US standards, bills of materials, manufacturing sequence and hours of labor per part, etc.

3. Supply supplemental drawings and other improvements to keep all original information up to date.

4. Supply technical advice regarding production techniques including all proprietary knowledge on parts manufactured by FMC and its parts suppliers for which FMC has manufacturing rights.

5. Supply technical advice and/or designs regarding the making and use of tooling.

6. Supply advice and information regarding sources of supply of items purchased by FMC for Oto Melara including delivery terms and prices.

7. Supply gauge design data and gauges as required (in addition to those that might be supplied by the US).

8. Prescribe inspection procedures.

9. Provide English texts for training and operational manuals.

10. Train personnel of Fiat, Lancia and Oto Melara and any other sub-contractor or co-producer in the US or Italy on manufacturing operations and procedures.

11. Provide surveillance of Italian on-site inspection and approval of any deviations.

12. Act as an agent to procure and control shipments of items manufactured in the US.

13. Perform any requested services and inspections on items of outside procurement.

Technical services assistance to be rendered by FMC included: "assistance rendered by managerial, engineering, production and staff personnel of the company and its supporting activities, including activities such as question-answering, providing advice and suggestions, explaining designs, investigating specific problems, obtaining information,

and performing other duties to effectuate the purposes of the agreement." In turn, Oto Melara obligated itself: to "build M-113's and related vehicles in accordance with United States standards specified by FMC with particular attention to maintaining interchangeability of components and parts between vehicles produced in the United States and those produced in Italy (with certain agreed exceptions)" (Ref. 13).

The US wanted no chance of failure and the MOU between the IMOD and the USDOD signed on 12 February 1963 provided for standardization by stating that:

> The Government of Italy agrees to insure that all M-113 vehicles produced in Italy under the provisions of this Memorandum are manufactured in conformance with drawings, specifications and changes thereto furnished for the production of the M-113, under the system of measurements called for in the drawings and specifications, under United States standards of quality and precision and further agrees that such vehicles will be inspected and accepted under United States standards of inspection and acceptance (Ref. 15).

Basic HAWK and HAWK II (HELIP). Basic HAWK was developed in the 1950's as a low altitude defense system to complement high altitude defense systems such as NIKE AJAX and NIKE HERCULES. Five countries decided to participate in the effort to produce HAWK in Europe and five prime contractors were selected: ACEC in Belgium, Thomson-Houston in France, Phillips in Holland, Telefunken in Germany, and Finmeccanica in Italy. After much negotiation and many compromises involving considerations of balance of payments and repatriation of technology within the European consortium, as well as financial arrangements and participation of the US Government and Raytheon, the venture got under way in 1959, with first European deliveries in 1962 and final deliveries in 1965.

A NATO HAWK Production and Logistics Organization (NHPLO), was chartered within NATO to implement the program on behalf of the participating Governments. The NHPLO, in turn, created the NATO HAWK Management Office (NHMO), in order to accomplish the task. The five prime contractors organized and staffed a consortium (each owning 20%) called Societe European Teleguidage (SETEL) to manage all industrial activities and in effect subcontract with their parent companies.

Originally, NHPLO did not have contracting authority and this activity was accomplished by SETEL; the charter was later amended to provide this capability. NHPLO Board of Directors established all policy and approved all expenditures, and the US Government, with a significant financial participation, was a voting member. In addition to production rights and financial participation, the US Government provided a significant amount of technical management support and assistance to the NATO program. Raytheon's role in the program was based on a license agreement with SETEL for manufacturing know-how. Raytheon provided, through US Government contract, some of the special manufacturing test tooling facilities; and, directly to SETEL, the necessary technical assistance, training, and training hardware.

In 1963 the US Army decided that the Basic HAWK program must be upgraded to assure a longer life to the system. As soon as the US made its decision, the participating NATO countries were confronted with the same decision. In Europe, the improved HAWK program was called HELIP (HAWK European Limited Improvement Program), a title that was descriptive of the fact that initially the consortium investigated ways and means to contribute to the US R&D investment by attempting to introduce a European developed low altitude acquisition system into the Improved HAWK program. Although this did not eventually happen, the name HELIP remained with the program. The configuration of HELIP today is the same as the US configuration of Improved HAWK.

Although the US initiated its improvement program in 1964, and NATO seriously considered it in 1968, it took five more years to start HELIP. By then, two additional countries, Denmark and Greece, had decided to procure HAWK under licensed production. In return for US financial participation in Basic HAWK, the US received European produced hardware which it supplied to Greece and Denmark. When HAWK became HELIP these two countries joined the new program, making seven countries in the European consortium.

Another reason the decision to start HELIP took so long was that military needs in some countries were more demanding than in others. Cost and economic differences between participating countries created

different pressures on the manner of the program's implementation. In addition, the European countries were learning from many of the weapons systems innovations that were being implemented by the US. That too caused delays because by holding back on decisions they hoped to take advantage of progress made in the interim. Finally, stemming apparently from the Basic HAWK experience, the governments made it clear that they were not interested in using a consortium-type prime contractor in the future. They wanted a single prime contractor fully responsible for all aspects of the program.

In 1971, NHPLO asked for competitive proposals from European firms to implement the program. All of the original NATO national prime contractors became contenders. Subsequently, the original European prime contractors decided to join hands and submit a single proposal with AEG-Telefunken as prime contractor. Raytheon submitted a proposal in 1972. It differed from Telefunken's in that while Telefunken proposed a total program, Raytheon restricted its proposal to hardware to be built in the US only. Raytheon's proposal was also less costly because the initial investment and learning had already been financed.

About this time, Germany indicated that in order to participate in the program, its portion of about 50% would have to be financed out of the basic offset agreement with the US. This meant that approximately 50% of the work would have to be done in the US. After another round of bidding, Raytheon was selected and received a contract in 1974. Ultimately 50% of the program was contracted in the US, 25% in Italy, 7% in the Netherlands, and approximately 4% in France and 3% in Germany. Raytheon, with a wholly-owned subsidiary located in Paris, has overall management responsibility but contracts to the European firms are directed from NHPLO. Nevertheless, Raytheon bears responsibility for the program performance (Ref. 16).

In the HAWK II Production Program Technical Assistance Agreement (17 February 1971), the NHPLO pledges that in respect to quality control it will:

> cause the co-producers to adopt and use inspection, testing and evaluation procedures in the manufacture of all end items, parts and components manufactured under this

agreement which are at least as stringent as those used by the Licensor at the time of its manufacture of comparable items (Ref. 13).

By all indications to date, the HAWK Program has been a success story.

CH53-G Medium Transport Helicopter. In 1968, following an extensive competition between Sikorsky's CH53-D and Boeing Vertol's CH47, the German Government picked the CH53-D as best meeting its requirements for a medium transport helicopter for the German Army.

The basic agreement was for co-production of 140 CH53-G helicopters, subject to patent and technology license agreements entered into between the US and German governments. As part of the agreement, the German MOD agreed to incur a pro rata share of the non-recurring development cost that had been expended by the US in development of the CH53-D helicopter, a configuration originally developed for the US Navy but which with minor changes could be adapted to the needs of the Germany Army, and redesignated the CH53-G. The MOD also agreed to make every effort to achieve standardization between the two models. The standardization effort was to be directed toward ensuring equipment, component, and assembly interchangeability under cooperative logistics agreements. Pursuant to this provision, the DOD and the GMOD mutually agreed to advise each other of all applicable modifications made by each and to exchange the technical data necessary for their implementation.

Based on the governmental MOU, a license agreement between the MOD and Sikorsky Aircraft was negotiated in December 1969, covering rights, fees, and dates. This agreement granted a non-exclusive license and rights for the manufacture of 133 CH53-G helicopters in Germany. Following the conclusion of the license agreement, a number of contracts were negotiated. Contracts for total production of 133 aircraft were later cut to 110 as a result of revised planning. The contract with Sikorsky was not modified, however, and the surplus dynamic components and flight control systems were diverted to spares.

Contracts were signed with VFW, and with two other aerospace firms, Messerschmitt-Bölkow-Blohm (MBB) and Dornier, to provide for tooling, personnel, hardware, software, and training. Technical advisors, instructors,

pilot and personnel training, handbooks and spares were handled between the German Government and the licensor. The first CH53-G assembled in Germany made its first flight in October 1971. By March 1973, more than 20 aircraft had been delivered. By April 1974, the mid-point of deliveries had been reached (55) and by July 1975 110 deliveries had been made on schedule.

An active product improvement program was maintained, as was contemplated in the original MOU. Initially, the Germans simply followed the lead of the US Navy and incorporated changes that had been initiated and developed in the US. Now the Germans seem occasionally to be taking the initiative on product improvements, suggesting that they have mastered the technology. Comments by major interested parties on the program have been almost universally favorable. Modern program planning techniques have been employed, embracing both the US and German contractors, and the program has run smoothly with no serious slippages or technical problems. This appears to be a case where licensed production has worked extremely well.

NATO-SEASPARROW Guided Missile Weapon System. This is an example of a joint operation resulting from agreements with NATO Allies to set up a consortium for the development and joint use of the SEASPARROW missile system. The project includes Belgium, Denmark, Italy, the Netherlands, Norway, and the United States. A Steering Committee composed of representatives from each nation was set up with a small supervisory management office to work with a single prime contractor - the Raytheon Company.

Development costs were to be shared in accordance with a formula based on the number of systems required by each nation. Should the quantity required by any nation increase, its share of the development cost would increase; but if the number required decreased, the original share commitment would remain. The prime contractor was required to manage the program in such a way as to assure that the balance of payments remained balanced within each participating country. In point of fact, the SEASPARROW MOU included a 75%-125% BOP clause, providing considerable flexibility. This was considerably easier to work with, for example,

than the NADGE request for proposals which required ± 98% balance of payments. In the case of NADGE only the fact that the Germans agreed to give up 35% of their BOP in order to create flexibility made it possible for the contractor to operate successfully.

The successful SEASPARROW case is included here to emphasize the point that balance of payments understanding and agreements are an essential part of all licensing arrangements. Such agreements are a common NATO device for sharing the costs of cooperative projects, especially where common funding of infrastructure projects is concerned. The objective is to balance payments by subcontracting within each participating country a quantity of work equal in value to the systems to be acquired by each country. What often happens is that the program manager has great difficulty in finding qualified subcontractors capable of performing the level of technology each country wants performed within its borders as its price for participation in the program. In many cases it is not enough to have an advance understanding of the burden share. What also has to be worked out in advance is the type of subcontracting to be performed in each country, such as, for example the placement of orders for specialized electronics in Country X instead of power generating equipment.

F-16 Multinational Fighter. In June 1974 four of the original participants in the NATO F-104G program -- the Netherlands, Belgium, Denmark and Norway -- decided that they would standardize on a replacement for that aircraft. Major entries in the competition included the US Northrop P-530 COBRA, the Swedish VIGGEN, the French Dassault MIRAGE F1, and the US General Dynamics YF-16. The YF-16 was selected and was designated the F-16 Multinational Fighter.

The procuring nations have been invited to send personnel to the US to participate in the F-16 development, not only at General Dynamics, but also at the Systems Program Office, Wright Patterson AFB. European pilots will fly the prototypes and participate as members of the joint test team at Edwards AFB. European industry will participate during the same period, and in fact, parts produced in Europe will go on the last three full scale development aircraft (Ref. 17). Fokker-VFW B.V. of

The Netherlands will produce major fuselage and wing components for more than 500 planes and will assemble up to 102 complete planes destined for the Royal Netherlands AF and 72 bound for the Royal Norwegian AF. European countries will produce 40% of the value of the F-16s produced for their own use, 10% of the value of the 650 produced for the USAF, and 15% of the value of those bought by other countries.

In recognizing the complexity of effort required to carry out the undertaking, the MOU between the participating countries and the US provides for the establishment of a Multinational Fighter Program Steering Committee to be composed of one member from each of the parties involved. The purpose of the Steering Committee is to provide broad guidance, advice and counsel to the USAF Systems Program Director within the terms of the MOU. Each member of the Steering Committee is expected to be responsible for necessary consultation and coordination with the appropriate authorities of his own country and to be empowered to make policy decisions, determinations and findings within the bounds of the MOU. The MOU further grants to the Steering Committee the authority of the respective governments to enter into any necessary arrangements which are consistent with the MOU. It further provides that administrative services will be established in each of the European manufacturing plants (airframe and engine) and will be provided on behalf of each of the participating governments (Ref. 13). Administrative services prescribed include:

- engineering
- quality assurance
- contract administration
- price analysis
- management analysis
- manufacturing operations
- material management
- transportation
- packaging
- flight operations service

A unique feature of the F-16 MOU is its provision for incorporating a NATO standardization procedure when dealing with quality control. This is evidence of European progress in effecting industry-wide standards of procedure, as will be discussed further later. The MOU provides, in part:

> if the European participating Governments require that their quality assurance personnel and programs be used (that is, if the European contractors are required to comply with the NATO quality control system requirements for industry (ASAP-1) and other quality assurance documents), then the European participating Government inspection organization will provide certificates of conformity in accordance with STANAG 4107, par 9, prior to the US Government representative signing the DD Form 250 and accepting supplies (Ref. 13).

Observations. The problem of conversion noted in the previous section also applies to American-developed weapons licensed for production in Europe. For some of the cases reviewed in this section, however, the purpose in licensing US systems for production in Europe was as much to meet an immediate European need for which Europe had neither the technology nor the matured industrial capacity as to effect NATO standardization. In effect, Europe was expected to benefit from licensing to build a US product. In order to accomplish this, US production standards and know-how were transferred to Europe along with the technical data to assure that the weapon produced retained its basic American configuration and performance characteristics. The overall result in each such case was that the US weapons licensed for production in Europe remained in effect "American" and were interoperable with US produced weapons deployed with US forces assigned to NATO.

From the foregoing it is fairly evident that licensed co-production conveys to the recipient a value greater than the cost of the items themselves. The relative weight to be given this value will vary greatly as between US licensees and European licensees. A worthwhile study could undoubtedly be devoted to tracing through, where feasible, the effects of technical data transfers on the production capabilities of recipients. Suffice to say that the success of the data transfers that were reflected in the M-113, SEASPARROW, CH53-G and other programs is

attested to by more than just the fact that the products worked as specified. The transfer effect of these and many other projects have spread with the result that Europe is now capable of competing with the US in many categories of technology and production. There may now be too much competition for the size of the market. Morever, the largest market - the United States - has up to now shown little willingness to buy what Europe has to offer except under very special and unique circumstances.

MRCA - MULTI-ROLE COMBAT AIRCRAFT

Although the NATO Multi-Role Combat Aircraft (MRCA) project does not involve US participation, it is included here as an example of the spreading influence production standards are having on European production practices. It also provides a brief insight into the problems European industries have in working with each other.

Following approval of feasibility studies of jointly established requirements conducted by several aircraft companies in Germany, Italy and the United Kingdom, the companies concerned were asked to present a joint design proposal to meet the spectrum of operational needs for a replacement of the F-104G combat aircraft in NATO. The three nations formed a joint agency under NATO auspices called NAMMA and placed a definition phase contract with a joint industrial organization known as Panavia Aircraft GmbH. The contract structure is based on a single authority starting with NAMMA, through Panavia, as prime contractor, and two associate contractors, one for the engine - Turbo-Union, Ltd, and one for the gun - IWKA/Mauser.

In commenting on the problems encountered, Mr. Gero Madelung, Managing Director, Panavia Aircraft GmbH, told a NATO Procurement Workshop in 1974 that the MRCA had basically started out using MIL standards which had been fully introduced into two of the participating countries through previous cooperative defense work. He observed, however, that there were a large number of detailed problems arising from standards and manufacturing processes, as well as test procedures, which required and still are requiring considerable effort. In some areas such as communications equipment it has been necessary to provide different

"national fits" since the respective Air Forces preferred to retain in-service standardization in these areas.

Another problem area encountered was that of requirements. While it took considerable time to arrive at a consensus, the extensive joint effort of the Air Staffs concerned in arriving at a joint requirement contributed in part to an alignment of the operational philosophies. Although one might not expect that the size of the European Defense Theater would lead to so many delays, the increased diversity of external stores apparently did. Increased standardization of aircraft weapons between participating nations would materially reduce the problem.

Another difficulty encountered in the MRCA program, according to Mr. Madelung, was in obtaining agreement among participating governments, influenced by their industrial associations, on a uniform standard of contractual conditions. Also, government philosophies of contracting and, in particular, pricing turned out to be different in major aspects. A further difficulty involved sub-contract chains across national borders. A supplier in Country A, for example, who has to sub-contract part of his effort with a supplier in Country B, sometimes finds it difficult to execute full contract performance responsibility. Not all European suppliers are experienced in this sort of sub-contract management.

THE HAZARDS TO SECURITY

Important distinctions must be drawn between straight technology transfers to industrially advanced nations (which is what most of the earlier weapons co-production programs have been) and the by-products of cross-licensing and other mutually beneficial aspects of technological exchange. As long as US enterprise maintains proprietary control over manufacturing or processing facilities located abroad, it continues to realize returns to its technological assets. However, as a foreign affiliate acquires operative capabilities under a licensing arrangement and is then able to move on to "duplicative" and "innovative" capabilities from its acquired technological base, the asset (and the returns from trade and in the home market) may begin to erode. This and the problem of security pose certain hazards to the national interest.

National security considerations involved in licensing items on the US Munitions List cannot be ignored. It may well prove essential to the success of standardization, however, that national disclosure policies be rationalized more liberally.

Flow-back and up-grading clauses, which are common in commercial licensing, are designed to allow either party to benefit from the other's ability to improve on a given technology over a specified period of time. By the same token such clauses protect the licensor against the licensee's ability to improve on its newly acquired technology, thereby gaining a competitive advantage. It depends somewhat upon what markets are available to the licensee, but in the commercial world trading areas are generally as wide open as the marketing capability of the particular enterprise is equipped to handle. When it comes to military matters, however, an entirely new host of considerations must be taken into account. Who can sell what, where, when, and to whom has caused more problems in licensing of military production than all other licensing clauses put together.

A sample list of "flow-back" clauses will serve to illustrate the point that gives rise to the problem:

> HAWK II: The NHPLO and participating Governments respectively grant, and shall require each of its contractors to grant Raytheon, to the same extent as NHPLO or participating Governments obtain such rights from such contractors, a non-exclusive, irrevocable royalty free license, with a right to grant sub-licenses, to make,use, and sell through the world, radar and missile systems and items of radar and missile systems, under all patents, which it or its contractors may obtain covering improvements or inventions required to be reported under terms of this agreement.
>
> M-113 (from the MOU): The Government of Italy agrees to furnish, at no cost to the United States Government, such information and rights as may have been generated in technical data, information and inventions, relating to improvements and modifications in the design of the M-113 derived through production of the M-113 in Italy.
>
> M-113 (from the license between FMC and Oto Melara): Oto Melara will notify the United States Government through

the Italian Ministry of Defense and FMC of any improvements in design and production methods and techniques suggested by Oto Melara. Such improvements are subject to the approval of the United States Department of Defense or FMC prior to incorporation into the vehicles.

LEOPARD II (from the "Teaming Agreement" between Krauss-Maffei and FMC, dated 6 May 1975): Krauss-Maffei shall have the right to joint ownership of any invention, proprietary rights, applications for proprietary rights and know-how established and developed in the USA by FMC during the term of this agreement - no matter by what party - in the field of main battle tanks, provided that they are based upon the know-how or proprietary information of Krauss-Maffei.

All the technical data and commercial data (know-how) and information marked confidential or proprietary that one party may have received from the other party under the terms and conditions of this agreement or may receive in the course of licensing negotiations foreseen or in connection with the performance of any technical services, shall be utilized by the receiving party exclusively for the purpose of the above mentioned cost production study and marketing activities, and for no other purpose of any kind anywhere in the world. The receiving party shall not under any circumstances and for no purpose whatsoever disclose such data and information to third parties, directly or indirectly and in no part of the world.

CROTALE (paraphrased from the license, dated 10 July 1972, between Thomson-CSF and North American Rockwell Corp., appended to the "Teaming Agreement" between the two firms, bearing the same date): The licensee must keep Thomson-CSF fully informed at the earliest possible date of all modifications, patents, inventions or designs, or similar new developments as may be originated by the licensee - and to the extent of its ownership and right to do so, grant a perpetual, non-exclusive, royalty-free, transferrable license and right to manufacture and sell such items throughout the world for use in any weapons system, but excluding sales in the United States.

ROLAND II (from the license agreement between Euromissile, Groupment d'Interet Economique [having as sole partners S.N.I. Aerospatiale and Messerschmitt-Boelkow-Blohm (MBB)] and the Hughes Aircraft Company): The Licensee shall promptly deliver to Euromissile technical data fully describing changes to the ROLAND System which are developed by the Licensee. Euromissile, subject to the limitations and requirements of Art ___ (required USG regulations)

will have the royalty-free right to use and authorize others to use changes, including Licensee's technical data pertaining thereto, in the manufacture and sale of the ROLAND System for use by the armed forces of France and Germany. [Similar provisions are made for improvements (6.2.1, 6.2.2) except that improvements developed by the Licensee and forwarded to the Licensor (with approval of the USG) may only be used by the Licensor with the written approval of the Licensee.]

ROLAND II (from the MOU): [Article 2] France and Germany reserve to themselves and their contractors (subject to government approval) the exclusive rights of sale regarding the ROLAND II System to all other NATO countries and all other countries listed in Annex A (Code 22 list).

[Modifications and Improvements] The three partners will do all that is necessary to assure that each party hereto has at its disposal a right of reproduction within the life of the MOU, to all the modifications and improvements, for their own use, and for the purpose of exporting ROLAND within the scope of Articles 2 and 3 (Sales to third countries and financial provisions).

[Article 4 - Security Provisions] The three partner countries agree that no sale or other disposition of the ROLAND System will be made unless and until the receiving country shall agree to protect ROLAND classified information in accordance with existing security agreements and shall agree that it will not transfer the ROLAND System and information relating thereto in any manner without the prior consent of (1) the partner(s) originating the sale and (2) the partner(s) who has (have) exclusive rights to sell to the receiving country and in no event permit the sale to any country listed in Annex A.

While these clauses vary in their phrasing and structure, the overall import is the same. The licensor is entitled to complete flow-back data resulting from changes, modification, innovations and inventions the licensee may make during the course of his production run. It makes no difference whether the licensor is US or European; the critical issue is technological feed-back. Whatever the original motivation for the licensing arrangement might have been, no one is later supposed to gain a competitive advantage thereby. How then does one reconcile government export controls to such a situation?

In the final analysis, two factors, both essentially government-oriented issues, control the prospects for the future success of licensing as a tool for achieving NATO standardization. The first is the security/commercial sales issue. The second is the management philosophy adopted for the industrial implementation phase.

During the course of this study no policy difficulty was found with respect to those provisions of licenses that are more or less boiler plate in nature. What is almost universally difficult, however, is the authorized sales territory (or third party sales) which the licensee is granted under terms of the agreement. The issue of licensed territory seems to vary in intensity in direct proportion to the sophistication of the weapon involved, the constraints arising for the most part out of US concern for world peace, foreign policy, national security, and economic return. The first three constraints appear to vary in importance between the US and its Allies, but economic return is an overriding issue for several Allies and colors all negotiations.

In the case of weapons developed and produced under a NATO standardization program, the US will be dealing with weapons systems derived from mixed US-European technology. The fact that items standardized in the future may contain large proportions of US-European derived technology naturally affects the approach to be taken to monitor and control the transfer of technology. This may require changes in US policy as well as in methods of controlling transfers of technology in order to accommodate NATO standardization.

It is not unlikely that MOUs of the future will declare that all elements of a particular weapons system will be considered candidates for advanced technology transfers, and then list the exceptions, such as:

a. Fire control computer software.

b. Electronic warfare equipment, including electronic countermeasures and counter-countermeasures.

c. Elements of the main propulsion system such as combusters, high pressure nozzle vanes, advanced

fuel controls, etc.

d. Integrated circuitry and the processor elements of specialized radars.

In short, it will necessitate the development of protocols that in specifying sales territories will delineate whether the equipment sold may or may not contain certain US technology. Should the US wish in the future to embargo or restrict sales to a particular country in a sales territory previously granted to a European licensee, or previously staked out by a European licensor, the US would risk obvious strains on foreign relations in attempting to block transactions involving items of US-origin produced in Europe, in the absence of such protocols. It may be begging the question to provide simply that configuration and performance of systems to be provided to NATO and to non-NATO countries (in short, to all countries) will be determined by mutual consent of the parties concerned at the time.

It is beyond the scope of this study to solve this problem. The solution will ultimately depend on the degree of national commitment to standardization and tradeoffs with other national objectives. To be successful, however, standardization must be provided with a sufficiently broad management and marketing base within the Alliance to assure an equitable recovery of investment costs without forcing each participating partner to compete its "standardized" product in the third world. While it may be unrealistic to suggest that any Western industrial power would willingly forego its right to sell its products wherever the opportunity exists, the liklihood that restrictions on third world sales may become more negotiable will vary in direct proportion to the size of the NATO market that can be guaranteed each partner in a standardization program.

Competition among NATO partners in arms sales in the third world has roots in individual national policies - foreign and domestic, political and economic - that are also beyond the scope of this study. However, national protection of technology without NATO standardization, appears more to abet than to impede such competition; while shared control of technology within NATO standardization would seem to restrict

competition and extra-NATO sales. Especially for the US, the UK, and France, there is a need for greater harmonization of technology transfer, arms sales, and NATO standardization policies.

MANAGING MULTINATIONAL PROJECTS

The point of this section can be summarized in a quotation from Mr. Thomas V. Jones, Chairman of the Board of Directors and President of Northrop Corporation: "Striking progress has been made in US management of technology but now we must make similar progress in the technology of management" (Ref. 18).

While there have been a number of NATO projects, management arrangements for each have been patterned on one or a combination of two or three basic designs. On the government side, a favorite arrangement for exercising policy control has been the NATO Production and Logistics Organization (NPLO). NATO in fact developed and adopted a "standard charter" for NPLOs in 1962 (Ref. 19). NPLOs usually have Boards of Directors consisting of national representatives and a management "Agency" whose responsibility it is to implement contracts. In more recent years "Steering Committees" have become more prevalent than NPLOs. Their basic structure has tended to be less elaborate although the overall management function is basically the same.

On the industrial side, there are basically three types of management arrangement. Where a number of countries are involved in which development and/or production is planned, it is sometimes preferable for the participating industrial organizations to form a consortium. Where a lead nation approach is taken to either development or production, a single national prime contractor usually takes full responsibility for the overall contract. A combination of several national prime contractors each reporting to a central management office is also used. This usually requires that one of the national primes or representatives of the firm act in a coordinating role.

The five following examples should suffice to illustrate the system.

a. NADGE had an industrial consortium (NADGECO Ltd) made up of prime contractors, headed by a US firm that took the management leadership. An intergovernment Management Office (NADGEMO) with similar responsibilities, but not headed up by US leadership, represented the participating nations. Contracts with the consortium were made by the separate governments.

b. HAWK had a similar industrial consortium (SETEL), with no US company present but relying on substantial transfers of technology from a US contractor, and matched by an intergovernment group (NHPLO) with similar responsibilities. The US company had a contract with the industrial consortium.

c. The F-104G project had no such industrial consortium but had instead four different groupings in the four participating countries, each country having a contract with the US licensor of the system. An intergovernmental counterpart was set up as a single management unit under NATO similar to those of NADGE and HAWK.

d. SIDEWINDER had a single company in West Germany as the prime contractor, receiving technical data from the US licensor, who was uninvolved in managerial problems. The several governments created a single management agency, which signed the contract with the industrial prime contractor.

e. SEASPARROW had a government management agency that was almost wholly American, located in the US, and an American prime contractor from which contracts were let for development and production (of components) of the system.

There is no simple test one can apply to determine whether one arrangement is superior to another. In each of the projects listed above the arrangement suited the particular project. If the product is for use of individual nations (where the item is not standardized, although it may be compatible and, to some degree, interchangeable), management will tend to be decentralized. The reverse will be true if the item is to be common to the participating partners. A systems engineering management organization is likely to be accompanied by decisions to expand authority in areas of contracting, company selection, pricing and technology. Efforts to determine management structure only after other elements are decided may leave the organization to face conflicting decisions made by those not having sufficient expertise to prevent conflicts in guidelines, making the management task very difficult.

Two general observations about management options appear warranted: first, no government is likely to be happy with the management of cooperative projects so long as neither it nor its industry participates in its control on a basis corresponding to its contribution. Second, almost any management arrangement will work if there is the will to make it work and if the personnel assigned have an adequate background both technically and managerially.

Difficulties within NATO management organizations have been subjected to many studies (cf. Ref. 20) and discussed at key symposia (e.g. Ref. 21). One international symposium concluded that problems arise largely from governments continually expressing dissatisfaction with progress and trying to make decisions for which their representatives are unprepared; governments trying to regain control and authority which had been shared; governments assigning men to tasks they were technically incapable of performing; companies trying to gain for themselves shares of responsibilities that should have been cooperatively determined; companies assigning individuals to jointly controlled agencies who were not adequately prepared for their positions; and companies placing (usually commercial) orders ahead of their cooperative responsibilities (Ref. 21).

A few essential prerequisites for successful management can be inferred from the past:

a. Prepare and agree to precise military requirements at the outset. Differences in military concepts and requirements due to differences in combat environments and differences in national standards and logistics may lead to local (national) adaptations of the basic concepts. Such adaptions should be limited as far as possible and clearly defined in the MOU.

b. Define the complete equipment specifications judged necessary for all phases of the project.

c. From the outset, government and industry should be in basic agreement on all phases of a project up to and including development, engineering, production and eventually deployment.

d. There must be a sense of willingness among the partner countries to participate and to continue to cooperate throughout the project.

e. Operate through one central controlling body (whether a single firm or a consortium) having sufficient delegated authority and responsibility from the governments concerned.

f. Assign only personnel with proven experience, whether technical or executive.

g. From the outset, clearly define the funding commitments and responsibilities of both government and industry.

h. Design the international management arrangements so that it will be possible to operate without having to refer back to individual governments except in unusual and unforeseen circumstances.

i. Use a flexible BOP clause in order to facilitate parcelling out work assignments.

j. Adopt a common measurement system.

NATO has no permanent procurement role, no established procurement regulations, no generally applicable standards on which contractors may safely rely, and on which they can predict costs and perform forecasts. Systems acceptance is new to NATO and delegation of central authority to NATO is still new to the nations despite its quarter century of existence.

Each program has a new set of rules developed as it goes along, subject to the individuality, personal influence and variety of experience of each new group of people selected to lead and run a NATO project. Regardless of what organizational options may be chosen to manage future NATO projects, NATO should begin now to develop a set of procurement regulations under which NATO and industry can operate. The success of a NATO standardization program will depend as much on how well the nations apply themselves to systematizing quality controls and harmonizing production, reliability, safety, testing, maintenance, and training standards as it will on the adoption of management prerequisites such as those listed above.

ISSUE-ORIENTED OBSERVATIONS

1. It has not been US policy to purchase weapons systems from foreign sources other than on those rare occasions when the off-shore product was either considered superior to any system then available

in the United States or offered the only option available within a given time frame. Those occasions when the US has tested a European system in open competition against an American-bred product for the avowed purpose of selecting the winner regardless of national origin are sufficiently rare as to have little or no meaning in terms of trends or of raising hopes that Buy American policies are a thing of the past. Europeans, to whom quid pro quo is now the accepted mode of dealing with their Allies on defense matters, are not apt to be impressed by talk of "two way streets" and "standardization" without more positive evidence from the US Congress, the American people, and industry itself that the US will adopt foreign weapons as the price for NATO standardization. Talk and studies of licensing options will serve no useful purpose in the absence of a positive national policy and a demonstrated method of proceeding. To date the US has shown neither.

2. Standardization should be approached as a management problem of national scope and importance. A Federal policy, not just a State-Defense policy, is required.

3. In the final analysis, government-to-government decisions to co-produce military equipment by licensing production among two or more NATO partners depend on being able to muster sufficient national political will to overcome the institutional pressures against exporting defense technology and importing foreign weapons.

4. National attitudes toward defense matters and the constraints placed on overseas operations of armament manufacturers are responsible for the suppression of international competitive factors which tend to produce efficient industries and for the fragmentation and overlapping of technological efforts worldwide.

5. Multinational industrial cooperation, if properly organized at every stage, creates possibilities for national cost savings. By better distribution of work, already existing capacity can be more fully utilized and the duplication now existing in virtually all categories of R&D and production can be avoided.

6. The degree to which production standards developed on either side of the Atlantic over the past thirty years differ from each other now and in the future will have a definite bearing on the size of conversion costs that will be involved in future programs. Such costs will need to be weighed against R&D savings that recourse to licensing may be designed to generate. It may, however, prove a worthwhile price to pay for standardization if conversion costs cannot be avoided.

7. Licensing arrangements can be greatly facilitated by the choice of licensee. In mastering problems of the types illustrated by examples discussed in this appendix, a US licensee will experience more or less difficulty depending on the amount of know-how it has acquired from working on previous foreign contracts. This suggests that it may be more economical in the long run to select licensees that are already affiliated with foreign licensors than to subject the imported item to price competition in the classic sense. The US should re-examine its policies with respect to encouraging defense contractors to establish working relationships with foreign affiliates.

8. The single most troublesome aspect of licensing is security. A dichotomy exists between the laws dealing with licensing of items on the US Munitions List and the interests of standardization. The dichotomy springs from the very practical and catholic interests that both European and American licensors have in preserving and/or broadening (as the case may be) their share of world markets.

9. In the case of weapons developed and produced under a NATO standardization program, the US will be dealing with weapons systems derived from mixed US-European technology. This will affect the approach it will need to take in order to monitor and control transfers of technology both before and after they have been incorporated into weapons systems. Changes in policy as well as in the methods of controlling data transfers should be examined to determine the potential impact on standardization.

10. European licensors that become entitled to flow-back data from American licensees will necessarily be reluctant to accept US

proscriptions on their rights to take advantage of increased performance and reliability that US innovations may have added to their products, especially if it means not being allowed to capitalize on third party sales. If licensors are not allowed to use such data because of security, political, or economic reasons, depending on the circumstances and who the prospective buyer may be, the limiting of specific third party sales to sanitized versions, or none at all, could well prove frustrating to standardization. Some obvious accommodations may therefore have to be made to overcome the inherent pitfalls of the third party sales problem.

11. To avoid the hazards implicit in the above observation, standardization must be predicated on a sufficiently broad marketing base within the Alliance to assure an equitable recovery of investment costs without forcing each participating partner to compete its "standardized" product in the third world market. To accomplish this will mean that participation on any given project should include more than the usual mix of three of four partners.

12. Experience to date suggests that large pay-offs may be expected from greater effort to develop more common manufacturing standards and practices throughout Europe and the United States. Some progress has already taken effect in the form of Europe's gradual adoption of NATO sponsored quality control standards and the US federal system of codification. Much remains to be done, however, in areas of production standards, drawings and specifications, fasteners and the like, reliability, overall producibility, fiscal accounting, and pricing policies. The extent to which success may crown efforts to gain more acceptance of US standards in Europe, or vice versa, should impact on problems associated with "Americanization" of imports. Not only would reductions in normal conversions save time and cut costs, but they would have the additional benefit of helping to overcome the reluctance of US industry to become more heavily involved in foreign licensing.

13. Standardization can be achieved only by adopting a systematic approach to the examination of weapons options before national decisions are made to proceed with unilateral programs. The problem of reaching

agreement on weapons selection issues is one that should be approached by combining national technical, financial, political, and military interests at the same time. NATO already provides the forum in the North Atlantic Council. However, a higher order of platform than that represented by the Conference of National Armaments Directors may be required in order to incorporate elements in addition to those of defense. By scheduling manpower and work hours to match each specific task, standardization could become a more viable goal.

14. The degree of success any industrial licensing arrangement enjoys will depend on how well the management arrangements that are established under it work. From the management models examined, several principles emerge. Government and industry must:

a. Want to work together.

b. Have a clear, definite set of requirements and specifications.

c. Operate through one strong, full-time joint management agency, having central contract authority and full powers to act on behalf of the governments.

d. Operate through one prime contractor with all others as associate contractors.

e. Operate from a system of standard procurement regulations, including standard measurements.

f. Avoid undue influence on decision making through recourse to political interference.

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Appendix B

LAWS, POLICIES AND REGULATIONS AFFECTING NATO LICENSING

INTRODUCTION

(U) Laws, policies and regulations affecting co-production and licensed production of defense equipment among NATO partners are not standard. This appendix presents notes and comments on such laws, policies and regulations with a view to assisting US policy makers in the formulation of US policies, directives and guidelines for facilitating co-production and licensed production arrangements within NATO.

(U) The appendix begins with a brief statement about the typical content of a license for production with examples of some of the key terms that are used in license agreements. The main section of the appendix is a digest of a key publication of the North Atlantic Council on "National Law, Policy and Regulations Concerning Procurement of Defense Material in which Industrial Property Matters are Involved" (Ref. 1). This is followed by a much shorter third section on current US directives and guidelines on licensed production issued by the Departments of Defense and State. A fourth section presents two examples of how US and Allied policies and laws are reconciled in inter-governmental Memoranda of Understanding.

LICENSE CONTENT

(U) A license is a technical and legal agreement that deals with a system, prices, and markets. The content of a license deals with technical data, inventions, patents, industrial and intellectual property, trade

secrets, and with the rights to use many of these and to produce and to sell. In a license there is an agreement on the sale of information and of authorizations to use that information. The system and information are identified through specifications, drawings and citations. There are statements of the extent of the production, the production rates over time, how the system will be priced, what the fees and other reimbursements are, and what the rights are for things that the buyer discovers. There are feedback rights for what is developed on the job. There is a discussion of the allocation to third countries. Changes in design and add-on technology, and how these are paid for, are discussed. The know-how and technical assistance that goes along are stipulated.

Examples of Key License Terms

(U) Examples of patentable inventions are new methods, techniques, processes, machines, apparatuses, manufactures, products, matter compositions, or new uses or improvements thereof.

(U) Examples of industrial property are inventions, utility models, and industrial designs. In some NATO countries all of these examples are patentable.

(U) Examples of intellectual property are patents, utility models, designs, copyrights, trademarks or trade names or service marks, and trade secrets.

(U) Example of trade secrets are unpatented inventions, manufacturing processes, shop practices, design drawings, know-how, technical data of all kinds, and lists of customers or suppliers.

(U) As the examples indicate the above terms are overlapping in their meanings. Technical data, however, is generally distinguished from industrial property.

LAWS, POLICIES, AND REGULATIONS ON DEFENSE INDUSTRIAL AND INTELLECTUAL PROPERTY

(U) The North Atlantic Council's publication "National Law, Policy and Regulations Concerning Procurement of Defense Material . . .," (Ref. 1) is a guide for use in negotiation of international cooperative agreements on research, development, production or procurement of military

equipment. The material selected for digest is that which is especially relevant to licensing in Belgium, France, Germany, Italy, the Netherlands, the United Kingdom, and the United States. The topics covered in this digest are

- Industrial and intellectual property protected by patents or otherwise
- Use of industrial property for defense purposes
- Use of privately owned technical data
- Government compulsory acquisition of rights to patents and to technical data
- Use of industrial property rights without authorization of the owner: liabilities and regulations
- Use of unappropriated funds versus long term licenses
- Government contractual activities versus industrial property rights
- Activities in government owned and operated establishments
- Activities in government owned but contractor operated establishments
- Activities in contractor owned and contractor operated establishments
- Activities in government owned establishments for another government
- Activities with government equipment or technical information loaned to industrial establishments of other countries for test and evaluation purposes
- Exploitation and disposal of industrial property belonging to the state
- Purchase of industrial property rights
- Disposition of industrial rights abroad
- Control on export of industrial property or rights
- Standard R&D contract provisions
- Standard purchase or supply contract provisions.

Industrial and Intellectual Property Protected by Patents or Otherwise

(U) Industrial and intellectual property protected by patents or otherwise (in countries as indicated by parentheses) includes (1) (NATO) "patentable inventions", i.e. a new method, technique, process, machine, apparatus, manufacture, product, composition of matter, or a new use or

improvement thereof, (2) (Germany, Italy, Portugal) "utility models", i.e. working instruments, implements, or items in a new form, (3) (NATO) "industrial designs", i.e. appearance, ornamentation, or shape, (4) (some countries) "functional design", and (5) (NATO) trademarks. Foreigners, persons or corporate bodies, may apply for the protection with the same advantages as nationals.

(U) Patentable inventions must be novel and useful in industrial application in order to be protected by patents. Excepting Germany and the United States, NATO countries have provisions for granting a compulsory license for failure to work a patented invention.

(U) The duration of patents in NATO countries is from 15 to 20 years from date of filing or date of issue. The period of protection for utility models or industrial designs is often less. Except for Canada and the US, NATO countries require annual fees.

(U) All NATO countries have laws that protect classified inventions relating to defense (see Convention F at end of this Appendix).

(U) Protection for industrial designs is provided for in the NATO countries either specifically, by copyright law, or by special patent protection (Italy, United States). All NATO countries are parties to some of the trademark conventions (see Conventions I-L). There is protection in some countries for functional design. France has a significant number of design applications, but in most countries applications for patents are much more numerous. In some countries the new aspects of a functional design can be patented.

Use of Industrial Property for Defense Purposes

(U) All NATO governments can use patented inventions for defense purposes subject to payment of reasonable compensation. In all NATO countries, inventions can be placed under secrecy but the governments may be liable for damages for this use of the inventions that are in secrecy. In all NATO countries, the owner of a patent used by the government without prior authorization by the owner or license is entitled to the payment of reasonable compensation. In some countries such payment may be limited to reasonable royalties. In Germany the compensation

may also include damages for the loss of profits and lost markets.

Use of Privately Owned Technical Data

(U) Technical data is dealt with differently from industrial property. In the United Kingdom technical data is dealt with under the provisions of the Defense Contracts Act. In the United States, the use of privately-owned technical data by the government entitles the owner to compensation only in case of a breach of contract, or, if proprietary information is disclosed by the US, through suit under the US Foreign Assistance Act of 1961. In Germany, the right to sue is dependent on the existence of a contract or other type of commitment.

Government Compulsory Acquisition of Rights to Patents and to Technical Data

(U) Except for the US, NATO countries have some authority to compulsorily acquire rights to patents. The scope of authority varies. In Germany, copyrights may be used by the government for public security purposes without payment. In Italy and the Netherlands the authority is based on national security and public interest; in Belgium and France it is based on defense purposes. In Italy, the Netherlands, and Belgium, reasonable compensation is due to the owner. In the Netherlands a specific legislative act is required.

(U) Similar principles apply to technical data. However, the right to use privately-owned technical data in the Netherlands, can be acquired only by agreement with the owner. Belgium cannot compulsorily license, but for home defense or state security it can compel full knowledge of an unpatented invention or a trade secret.

Use of Industrial Property Rights without Authorization of the Owner: Liabilities and Regulations

(U) In France, Germany, Italy, and the Netherlands, government contractors can be sued for infringement of the proprietary rights of third parties. In Italy the contractor assumes full liability. In Belgium the government is liable for damages to the patent owner if it has not notified the contractor of existing relevant patents or designs. In France the contractor can claim reimbursement from the state. In Germany

the contractor negotiates with the owner of proprietary rights. The contracting authority may assist in the negotiations or negotiate directly with the third party. In the Netherlands the government contractor is responsible if he makes unauthorized use of any industrial property and the government promptly notifies the contractor of an infringement claim.

(U) In the United States, government contractors may not be sued for patent infringements (patented processes, equipment, etc.) authorized by the government and necessary for contract performance. The contractor must indemnify the US Government if the infringement arises out of the furnishing of supplies normally offered for sale in the commercial market. However, such indemnity is not applicable in R&D contracts involving such supplies. The patent owner's sole remedy for infringement of his patent or copyright in such a case is a suit against the US Government in the US Court of Claims.

(U) The United Kingdom, in defense contracts, may authorize the use of patents and registered designs. Technical information in the contractor's possession can also be used despite the contractor being a party to a restrictive agreement that otherwise would prevent his using the information.

(U) Any NATO government can enter into a contract for the production of a proprietary item despite lack of a license by the contractor for patented inventions or technical information that are available to the government. If trade secrets or other needed proprietary information are not available to the government, then generally the government must contract with the owner of the rights.

(U) Any NATO government can make use of patented inventions for defense purposes without authorization of the owner, but subject to just compensation to the owner. In Italy, contract clauses require the contractor to acquire the user rights, with government expropriation if necessary. All countries except the United Kingdom and the United States can use means such as compulsory licenses, expropriation or "d office" licenses for defense (France), to obtain rights to use privately-owned

inventions. Most countries use their best efforts to obtain necessary license rights where the owner is willing to negotiate and there is sufficient time for negotiation prior to letting the contract.

(U) In the United States and Germany, the statutes, regulations, or practices generally require that the purchase of property or services by the Armed Forces be made through open competition. A contract for a patented item may be awarded to a bidder despite the bidder's not being licensed by the patent owner. The US Government may buy a license from the patent owner and apply a reasonable royalty factor to bids by non-licensees but this is generally not feasible. In the United States direct negotiation can occur, without competition, with the owner of a secret process or of other proprietary data that is necessary for the performance of the contract but is not accessible to the government.

(U) The rights acquired by NATO governments to industrial property resulting from employee inventions and from R&D contracts are covered by the Comparative Study "Information on the Regulation in NATO Countries Concerning Employees' Inventions" (cited in Ref. 1).

Use of Unappropriated Funds versus Long Term Licenses

(U) Patent licenses or other types of agreements by governments may extend for the life of a patent and thus commit the government to pay royalties or other fees over periods longer than the government normally can be committed. The US funds for these royalties or fees are in the funds that pay for the item or process as it is procured. Thus the license agreement contains a provision that such royalties and fees are contingent on the availability of appropriated funds. In practice this presents no serious difficulties. Canada, Germany, Greece, and Norway have no such statutory or budget regulations. In Italy the necessary credits must be voted by Parliament. France and the Netherlands likewise have limitations but in the United Kingdom payments would normally depend on an initial authorization.

Government Contractual Activities versus Industrial Property Rights

(U) Activities including research, development, and production may be performed either by government or by contractors in establishments

that are owned by government, contractors, or third parties. Industrial property made during these activities is procured in accord with national laws and regulations and with contracts or license agreements. The laws and regulations are those governing relations between employer and employee and those relating industrial property rights and defense or other government purposes.

Activities in Government Owned and Operated Establishments

(U) In Canada, France, Greece, Italy, the Netherlands, the United Kingdom and the United States, inventions made by government employees within the scope of their employment become government property, with appropriate compensation to the employees. In Denmark, Germany and Norway the inventor has a theoretical right to his invention but the government can acquire title to it; however, the German government in practice never acquires the titles. In Belgium the Defense Minister may claim the invention for defense purposes. In Germany unlimited use can be made of employees' inventions and this is done by the Federal Minister of Defense in about half of his cases. More detailed information is in the study "Information on the Regulations in NATO Countries Concerning Employees' Inventions" (cited in Ref. 1).

Activities in Government Owned but Contractor Operated Establishments

(U) In the case of activities in government owned but contractor operated establishments, rights to inventions in individual cases are governed by contract but the government normally reserves a non-exclusive license for its own requirements.

(U) The US Government normally acquires title to inventions made under an R&D contract. If the invention was not a primary object of the contract, the contractor may obtain title as an incentive for risk capital to perfect the invention, but even in this case the government will have a royalty-free license. If the contract is for technical data, the US Defense Department has unlimited rights to the items, components or processes developed, except for limited rights if these were so contracted for, or were developed at private expense.

Activities in Contractor Owned and Contractor Operated Establishments

(U) For activities in contractor owned and operated establishments, rights to inventions are generally established in the contract. Generally, titles to these inventions are assigned to the contractors but the government retains a non-exclusive license.

(U) In France rights from an R&D contract vest in the contractor but the government is granted a license.

(U) In the United States an invention (e.g. creation, development or improvement of products or processes) during defense contracts generally results in the contractor retaining title to the invention and the US Government acquiring a royalty-free, irrevocable and non-exclusive license throughout the world for governmental purposes.

Activities in Government Owned Establishments for Another Government

(U) For activities in government owned establishments for another government, the relevant agreements are dominating. Generally the performing government extends the requesting government at least a royalty-free right to work the invention in the territory of the requesting government.

Activities with Government Equipment or Technical Information Loaned to Industrial Establishments of Other Countries for Test and Evaluation Purposes

(U) For activities with government equipment or technical information loaned to industrial establishments of other countries for test and evaluation purposes, there is a tendency for a royalty-free license for resulting inventions to be awarded to the originating government (Canada, Germany, Greece). In the case of a US loan with bilateral or multilateral data exchange, generally there must be a flow back to the United States of any further developments or improvements resulting from the use of this information.

Exploitation and Disposal of Industrial Property Belonging to the State

(U) Most NATO governments operate on a case-by-case basis with respect to exploitation and disposal of industrial property that they own. All NATO governments use their industrial property rights for

government purposes. In the case of the United States royalty-free non-exclusive licences are usually available to the public. For other NATO countries, government owned industrial rights are generally used by third parties under licensing agreements or development or production contracts, with fixed charges or royalties based on normal commercial practice.

Purchase of Industrial Property Rights

(U) All NATO countries can, and most do, purchase industrial property rights. However, often they stop short of outright purchase and acquire a non-exclusive license to the rights. The NATO governments usually acquire privately-owned industrial property rights through contract. Belgium, France, and Norway may acquire the rights by compulsory license; France by a license "d office"; France, Italy, and Norway by expropriation.

(U) Germany usually, in R&D contracts to industry, reserves the right to use the results. When the contract object is reproduced by a third party for procurement by the government, the contractor receives a reproduction fee for the intellectual services that had been performed under the contract.

(U) In the United States, the Armed Services may purchase the entire right, title and interest in the patent, or a narrow license for specific purposes. Generally the Services do not purchase rights in a patent application because of the uncertainties of eventualities in the patent and the invention.

(U) The United States generally purchases rights for defense or government purposes. If the payment is to be through royalties there may be a limit to one Armed Service or government agency, or there may be joint negotiation between the patent owner and two or more Services or agencies. An important factor is that one Service or agency cannot obligate another.

Disposition of Industrial Property Rights Abroad

(U) All NATO governments can obtain patents abroad. If the US Department of Defense has title to inventions resulting from R&D, it may

allow the contractor to obtain the patents, sometimes with a royalty-free license to the government. If the contractor has title, it may file to obtain patents abroad. If the US Government has obtained a license under contract, it may require the contractor to assign rights in foreign countries for which the contractor has not filed within a designated time.

(U) Some countries limit the right to file abroad. In France filing must be first in France and France may file abroad in cases where the contractor does not. In some circumstances, Italy, Norway, the United Kingdom, and the United States prohibit a first filing abroad unless authorized.

(U) All NATO countries have arrangements to protect inventions that are kept secret for defense purposes. Authorization to file may be granted for NATO Agreement countries, NATO Agreement for the Mutual Safeguarding of Secrecy of Inventions Relating to Defense, or where there are bilateral agreements.

Control on Export of Industrial Property or Rights

(U) NATO governments control the export of industrial property or rights therein that have a bearing on defense. Control may be through reporting requirements, expropriation, or export bans on equipment and information. There are detailed regulations on export of arms, ammunition, military equipment, and related rights and technical data.

(U) In the United States, controls are exercised primarily by the State Department but are also exercised by the Department of Commerce and the Department of the Treasury. The US State Department's "International Traffic in Arms Regulations" requires State Department authorization for manufacture abroad of items on the US Munitions List or the furnishing of related technical assistance and technical data. Export of technical data may be approved by the State Department through manufacturing or technical assistance agreements.

(U) The US Department of Commerce is authorized by the Export Administrative Act of 1969 to control items, including technical data, as necessary, to further US foreign policy. Department of Commerce licenses are thus required for export of relevant items. The US Department

of the Treasury, as authorized by the Trading with the Enemy Act, controls transactions between US companies and certain Communist countries through requirements for a US Treasury license.

Standard R&D Contract Provisions

(U) Canada, France, Germany, Italy, the United Kingdom, and the United States have drawn up standard conditions for government R&D contracts. In Germany government departments are bound by standard clauses from their Federal Minister of Defense ABEI and ABFI for development and research contracts, respectively, with industrial firms. In the United States the Armed Services Procurement Regulations (ASPR) set out certain clauses.

Standard Purchase or Supply Contract Provisions

(U) Basic philosophies for equipment purchase or supply contracts are common to most NATO countries. These principles are detailed in "Guidance of NATO Procurement Authorities," which was prepared by the North Atlantic Council's Working Group on Industrial Property as a procurement checklist.

US POLICY DIRECTIVES AND GUIDELINES

DoD Directive 2000.9

(U) Licensed co-production by a foreign licensee may be undertaken after a prototype has been selected for procurement. DoD directive 2000.9 (Ref. 2),by the Assistant Secretary of Defense for Installations and Logistics, governing international co-production projects and agreements between the US and other countries or international organizations, is concerned with foreign production of a US weapon, communication or support system, or military item. Such co-production is under license from the United States and thus this directive is basic to licensing policy for the US licensor and foreign licensee case.

(U) Know-how that is furnished under the license may include R&D and production data and/or manufacturing machinery or tools, raw or finished material, components or major subassemblies, managerial skills, procurement assistance or quality control. Third country sales limitations and licensing agreements are included as required.

(U) Such co-production is a component of the US foreign military sales (FMS) program and is to be encouraged and supported by elements of DoD when it "is in the best interest of the US," "supplements and reinforces the US FMS program," and advances the objectives outlined in the directive as excerpted below:

A. The major objectives to be attained through co-production projects are to:

   1. Enable eligible countries to improve military readiness through expansion of their technical and military support capability.

   2. Promote US-Allied standardization of military materiel and equipment, which, in turn, would generate the establishment of uniform logistics support, procedures and expanded multinational operational capabilities.

B. Co-production programs directly benefit the US through:

   1. Creating in-country compatibility with the US standardized equipment, thereby creating Allied capability of supporting deployment of the US forces.

   2. Promoting the standardization of materiel or equipment to integrate and strengthen international military operations in times of emergency or hostilities.

   3. Encouraging multinational acceptance of strategic and tactical concepts and doctrine through the utilization of common military materiel.

   4. Encouraging the creation of complementary forces in Allied countries.

   5. Establishing or broadening the base for common and interchangeable logistics among free or Allied nations.

   6. Serving to improve procurement, production, contract administration and mutual support capability of friendly Allied nations.

(U) Co-production projects (foreign licensee of US case) may be initiated by the ASD (ISA) or the Defense Security Assistance Agency with prior ASD (I&L) coordination. With prior approval of these agencies, projects may also be initiated by the Military Departments and MAAGs. Technical and negotiating assistance and then managerial and reporting functions are provided. Also, as provided in DoD Dir. 2000.9, DoD positions are developed, legal clearances are assured and financial

guidance is provided. The criteria that must be met by a proposed co-production project include: (1) US defense supply or production base is not adversely affected, (2) critical material is not further limited, (3) future logistic support has been considered, (4) classified information is safeguarded.

Worldwide Co-Production Guidelines

(U) A publication (Ref. 3) titled "US Government Guidelines and Procedures for Reviewing Proposals for Co-Production Overseas of Defense Articles of US Origin" has been drafted by the Director, Security Assistance and Sales, Department of State and has been reviewed by the Defense Security Assistance Agency (DSAA), JCS, Military Services, ODDRE, ASD (I&L), and ASD (ISA European Region) and the OSD General Counsel. This publication is for the review within the Executive Branch and is in addition to the laws and regulations regarding the export of defense articles and related technical data.

(U) In the co-production, transfer may be made of technical data, production techniques, components, or equipment for the purpose of production or assembly in a foreign country.

(U) Co-production legal considerations include the Mutual Security Act of 1954 and the Foreign Military Sales Act (FMSA). FMSA permits co-production overseas when this best serves the foreign policy, national security, and economy of the US. FMSA requires that Congress be apprised of the proposed co-production and its probable impact on employment and production within the US. FMSA also requires that procurement under this co-production be less costly than US procurement and that its economic or other advantages not be outweighed by adverse affects on the US economy, industrial mobilization base, labor surplus, and balance of payments.

(U) This guideline publication quotes objectives and benefits of co-production from DoD Directive 2000.9. These are presented just above in the single-spaced and indented precis. The guidelines publication then notes that co-production will be encouraged since NATO standardization and rationalization is a priority goal of US policy. Guidelines are

presented in order that appropriate measures may be used, as the President has directed, to make more effective use of NATO defense resources; and procedures to be followed by US Government agencies are listed. These guidelines and procedures do not add anything further, not already noted, that is basic to licensing policy options and so they will not be summarized here. It might be noted though that the following are involved in the various procedures: State Department, DoD, Office of Management and Budget, National Security Council, ACDA, CIA and the Treasury Department.

(U) It should be noted that specific guidelines for NATO co-production/standardization were regarded as beyond the scope of this publication.

EXAMPLES OF INTER-GOVERNMENTAL MOUs

US-UK Cooperative Arrangement

(U) The negotiation of this cooperative arrangement and the experience in implementing it could well serve as a basis for a broader NATO arrangement that encourages licensed co-production.

(U) The September 1975 Memorandum of Understanding between the United States and the United Kingdom (Ref. 5) relating to the principles governing cooperation in R&D, production, and procurement of defense equipment and its April 1976 Annex I, Implementing Procedures, promote international (US-UK) production and procurement and are intended to fit into the broader context of NATO rationalization/standardization and to be compatible with any NATO arrangement that might subsequently be negotiated.

(U) This 1975 MOU and 1976 implementation furthers the aims of a May 1963 Arrangement for Joint Military Development and other offset arrangements with the UK in the area of defense weapons and equipment. Their aims include balanced production and procurement, including levels of technology as well as contractual values. With due regard for privately owned proprietary rights, necessary information and technology will be released. Item may be procured on a government to government or a government to industry basis.

(U) Specific efforts will be made to inform R&D offices, procurement offices, and industry of the provisions of this MOU. Industry must learn, on a timely basis,of opportunities such as requests for proposals. Impeding laws and regulations such as "Buy National" will be waived as possible. For example, impeding price differentials and import duties will not be included in evaluations and consideration will be given in evaluations of the potential NATO savings and/or increased NATO combat capability that results from NATO standardization or interoperability.

(U) Best efforts will be made to assist industry in negotiating licenses, royalties and technical information exchanges.

XM-1/LEOPARD 2 Memorandum of Understanding as an Example of the Basis for Co-production Licensing

(U) The essential content of a co-production license may be based on a memorandum of understanding (MOU) between governments. In order to illustrate this content, the Memorandum of Understanding between the United States and Germany is used as an example. In the following paragraphs the portions of this MOU have been selected that relate to the gun, to the turbine power package, and to some of the general elements of the agreement. The licenses to follow will include the specific details that are settled upon and the conditions and the safeguards that will make the data and license rights "fair and reasonable," with an equitable return to the contractors involved.

(U) The 3 August 1976 Addendum No. 1 to the December 1974 Memorandum of Understanding between the United States and Germany on the "US/FRG Tank Standardization Program" (Ref. 6) confirmed "that it is the intention of both parties that data and license rights on standardized items will be exchanged between them under fair and reasonable conditions."

(U) Germany agreed to deliver all available technical data required for the installation design of the 120 mm smooth-bore gun in the XM-1 turret. Manufacturing data used by the gun development contractor will be made available to the US Department of Army contractor. Test data requirements and unique US gun requirements will be delivered to Germany. Unique FRG turbine power package requirements will be made available to the

US Department of Army, and the manufacturing data used by the development contractor will be made available to the FRG or its contractors.

(U) The FRG will loan two units of the gun and an appropriate amount of ammunition and will observe the US testing of the UK gun and ammunition. The US will loan a turbine power package to the FRG for installation and test in a LEOPARD 2 tank in the FRG.

(U) Both countries will utilize standard metric fasteners at unit-level maintenance interfaces so that only one set of tools is required.

(U) Each party agreed to make total and complete disclosure of all relevant technical data and to do so in a timely fashion. The parties will make available to each other, and to their industries that are concerned, data on the items to be standardized so that their industries can submit technical and cost proposals. The industries may use the data only for preparing and submitting proposals.

(U) More detailed manufacturing data from the developing contractors will be exchanged later. Each government will include provisions in its contracts requiring its contractors to transfer such technical data on fair and reasonable terms and conditions.

(U) Technical know-how will be furnished in addition to technical data through the services of knowledgable technicians to consult with and assist the countries and their contractors. Cost for such technical assistance, including travel and living expenses and regular salaries, will be the responsibility of the requesting country.

(U) The FRG Ministry of Defense and the US Department of Defense will seek from their respective Parliament and Congress the support needed to continue the LEOPARD 2 and XM-1 programs as agreed in the MOU and its addendum.

(U) In accord with the NATO agreement on the release of information, dated 19 October 1970, and its implementing procedures, the information exchanged may be used only for the purpose of mutual instruction and for evaluation by government agencies. Release to a third party of relevant information will be allowed only upon approval of both the

Federal Ministry of Defense and the US Department of Army. Use of the released data and of the given information and later use of the knowledge gained from them, will be allowed only upon approval by both governments. Both parties will make certain that the rights of third parties will be observed within the scope of the information exchange.

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2. DoD Directive 2000.9, "International Co-Production Projects and Agreements Between the United States and Other Countries or International Organizations," ASD (I&L), 23 Jan 1974.

3. Director, Security Assistance and Sales, Department of State, "US Government Guidelines and Procedures for Reviewing Proposals for Co-Production Overseas of Defense Articles of US Origin," 20 Oct 1975.

4. Senate Report 94-1004, Conference Report Authorizing Appropriations for Fiscal Year 1977 for Military . . ., 28 June 1976.

5. Memorandum of Understanding Between the United States and the United Kingdom Relating to the Principles Governing Cooperation in R&D, Production, and Procurement of Defense Equipment, Sept 1975 and the April 1976 Annex I, Implementary Procedures.

6. Memorandum of Understanding Between the USA Represented by the US Department of the Army and the Federal Republic of Germany Represented by the Federal Ministry of Defense Concerning the Harmonization of the US Tank XM-1 and the FRG Tank LEOPARD 2, Dec 1974, including Addendum 1, 3 Aug 1976.

Attachment to Appendix B

INTERNATIONAL PATENT, DESIGN, AND TRADEMARK CONVENTIONS

A. Patent Cooperation Treaty (PCT), Washington, 29 Jun 1970 (not yet in force as of May 1975):

To provide national protection in signatory countries.

B. Convention for the Granting of European Patents (European Patents Convention), Munich, 5 Oct 1973 (not yet in force as of May 1975):

To provide a centralized office to grant European patents equal to national patents in European Economic Community (EEC), with a uniform legal system to be established by special convention.

C. Trademarks Registration Treaty (TRT), Vienna, 12 Jun 1973 (not yet in force as of May 1975).

D. Paris Convention.

E. Strasbourg Convention, 27 Nov 1973.

F. NATO Agreement for the Mutual Safeguarding of Secrecy of Inventions Relating to Defence and for which Applications for Patents Have Been Made.

G. Hague Agreement, 6 Nov 1925, London 2 Jun 1934, Hague 28 Nov 1960, Additional Act of Monaco, 18 Nov 1961, complementary Act of Stockholm, 14 July 1967:

Protection for designs, i.e. novel external shape, esthetic appearance or ornamentation.

H. Paris Convention for the Protection of Industrial Property (Paris Union), 20 Mar 1883, last revised at Stockholm, 14 Jul 1967:

Trademark protection.

I. Union for the International Registration of Marks (Madrid Union):

Trademarks and other rights (Belgium, France, Germany, Italy, Luxembourg, the Netherlands, Portugal).

J. Agreement for the Repression of False or Deceptive Indications of Source on Goods (Madrid Agreement):

Trademarks and other rights (Italy, Portugal, Turkey, United Kingdom).

K. Union Concerning the International Classification of Goods and Services for the Purposes of the Registration of Marks (Nice Union):

Trademarks and other rights (Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Portugal, United Kingdom).

L. Union for the Protection of Appellations of Origin and Their International Registration (Lisbon Union):

Trademarks and other rights (France, Italy, Portugal)

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Appendix C

PERSONNEL INTERVIEWED

The following individuals were visited or consulted by telephone during the course of the project (July-August 1976).

CONGRESSIONAL STAFF

Charles Cromwell	Senate Armed Services Committee
Hyman Fine	Senate Armed Services Committee
Jeffrey Record	Office of Senator Sam Numm (D-Ga.)
Herbert Schandler	Congressional Research Service
Charles Stevenson	Office of Senator John Culver (D-Iowa)
Hugh Strain	General Accounting Office

DEPARTMENT OF STATE

James Goodby	Deputy Director, Bureau of Politico-Military Affairs
Allan Holmes	Director, Office of NATO and Atlantic Political-Military Affairs, Bureau of European Affairs
Anthony Kochanec	Directorate of Security Assistance and Sales, Bureau of Politico-Military Affairs
Vladimir Lehovich	Office of NATO and Atlantic Political-Military Affairs, Bureau of European Affairs
William B. Robinson	Director, Office of Munitions Control
Archelaus Turrentine	Arms Control and Disarmament Agency

DEPARTMENT OF DEFENSE

MG Richard Bowman	Director, European Region, OASD (ISA)
MAJ Charles Carlton	US Army Military Assistance Institute

DEPARTMENT OF DEFENSE (Continued)

Donald Cuffe	Director, Program Planning and International Logistics, OASD (I&L)
Clark De Jonge	Office of Assistant DDRE (International Programs) [visit canceled]
K. C. Emerson	Deputy Assistant Secretary of the Army (R&D)
Robert Fiss	European Region, OASD (ISA)
LTC Harold Holtzclaw	NATO Standardization Division, European Region, OASD (ISA)
COL Lawrence Larsen	Chief, NATO Standardization Division, European Region, OASD (ISA)
Eugene Porter	Chief, Europe Division, Regional Programs, OASD (PA&E)
William E. Stoney	Deputy DDRE (Tactical Warfare Programs)
Ray Thorkildsen	Office of the Deputy DDRE (Research and Advanced Technology)
Milton Tulkoff	Europe Division, Regional Programs, OASD (PA&E)
Hunter Woodall	Assistant Deputy Under Secretary of the Army (Operations Research)

DEPARTMENT OF COMMERCE

Mansfield Sprague	Special Assistant to the Secretary of Commerce
Leon Strauss	Office of Export Development

INDUSTRY

David Alne	Consultant
John Amann	United Technologies Corporation
James Beggs	Executive Vice President, General Dynamics
Robert Brock	Boeing
Walter E. Edgington	Electronics Industries Association; NATO Industrial Advisory Group
Harry Frech	Director of Government Liaison, Olin Corporation
Thomas Lindberg	Boeing
BG John Lissett, USAF-Ret.	International Programs, General Electric

INDUSTRY (Continued)

Kenneth Mark	Boeing
Arthur K. Mason	DGA International, Inc.
Ronald McWilliams	Boeing
GEN Henry Miley, USA-Ret.	American Defense Preparedness Association
Ronald M. Murray	Associate Director, Hughes International
Joseph Pica	Boeing
S. N. Ross	DGA International, Inc.
James Scofield	Magnavox
Paul Skordas	American Defense Preparedness Association
Harold L. Springer	DGA International, Inc.
Timothy Stanley	International Economic Policy Association
LTG Arthur Trudeau, USA-Ret.	American Defense Preparedness Association
John Ulrich	Chamberlain Manufacturing Co.
MG Jack J. Wagstaff, USAF-Ret.	Boeing
Bart Walker	Northrop

EMBASSIES

RADM J. J. Binnendijk	Defense Attache, Embassy of the Netherlands
Gabriel de Bellescize	Counselor for Political Affairs, Embassy of France
Hans Scheel	Deputy R&D Attache, Embassy of the Federal Republic of Germany
RADM Kurt F. Seizinger	Defense Attache, Embassy of the Federal Republic of Germany
Brian E. White	Defense Supply Staff, Embassy of the United Kingdom

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Appendix D

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